Army Public Health Center

Public Health Information Paper

A Taxonomy of Injuries for Public Health Monitoring and Reporting

PHIP No. 12-01-0717

Addendum 1, Body Regions and Injury Types

Addendum 2, Fiscal Year 2018 Update

Approved for public release; distribution unlimited

General Medical: 500A

July 2017

Addendum 1 (Nov 2017) and Addendum 2 (Dec 2017)

APHC

REPORT DOCUMENTATION PAGE		*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
25-07-2017; 28-11* & 01-12**	FINAL+Addendums 1*&2**	January 2016-May 2017 - December 2017

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER n/a
A Taxonomy of Injuries for Public Health Monitoring and Reporting - Public Health Information Paper (PHIP) No.12-01-0717	5b. GRANT NUMBER n/a 5c. PROGRAM ELEMENT NUMBER n/a
6. AUTHOR(S) Veronique Hauschild, Keith Hauret, Melissa Richardson, Bruce H. Jones. Collaborating Author: Terrence Lee, contracted to AFHSB/DHA.	5d. PROJECT NUMBER WBS S.0048424 5e. TASK NUMBER n/a 5f. WORK UNIT NUMBER n/a
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Army Public Health Command, Clinical Public Health and Epidemiology Directorate, Injury Prevention Division; Aberdeen Proving Ground, MD 21010-5403	8. PERFORMING ORGANIZATION REPORT NUMBER PHIP No.12-01-0717
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Army Public Health Center, Aberdeen Proving Ground, MD 21010	10. SPONSOR/MONITOR'S ACRONYM(S) APHC 11. SPONSOR/MONITOR'S REPORT NUMBER(S) PHIP No.12-01-0717

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release/Distribution Unlimited

13. SUPPLEMENTARY NOTES THIS VERSION INCLUDES 2017 ADDENDUMS 1 (NOV) & 2 (DEC)

14. ABSTRACT [ADDENDUM 1 = Body Regions and Injury Types ; ADDENDUM 2 = Fiscal Year 2018 Updates]
This document establishes a taxonomy for categorizing and consistently defining physical injuries that are included in public health surveillance, monitoring, and reporting. The taxonomy includes a framework and standardized definitions that are operationalized with specific medical diagnostic codes (International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)). The taxonomy promotes the future standardization and comparability of epidemiologic efforts and will help prioritize injury prevention strategies. For example, calendar year 2016 medical encounter data for U.S. Army Active Duty personnel (including Reserve, National Guard) inpatient and outpatient visits (including purchased care) demonstrates that injuries caused by mechanical energy transfer far outnumber injuries from any other cause (97%). Of these, MSK injuries comprise the vast majority (83%), and most are cumulative microtraumatic injuries (69%). These cumulative microtraumatic injuries are sometimes referred to as overuse injuries since they are often associated with the excessive, lower intensity repetitive forces experienced by Soldiers during their physical training. In comparison to mechanical injuries, non-mechanical injuries present a much smaller magnitude of medial encounters. As an example, environmental heat and cold injuries comprise less than one-half of one percent (0.5%) of all Army injuries.

15. SUBJECT TERMS
public health, injury, epidemiology, diagnosis, ICD codes, Army, medical

16. SECURITY CLASSIFICATION OF: UNCLASSIFIED			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 94 A1-6; A2=4	19a. NAME OF RESPONSIBLE PERSON Veronique D. Hauschild
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER *(include area code)* 410-436-4655

Prepared by:
Veronique D. Hauschild, MPH [1]
Keith Hauret, MSPH, MPT [1]
Melissa Richardson, MPH [2]
Bruce H. Jones, MD, MPH[1]

In collaboration with:
Terrence Lee, PhD, MPH [3]

Contributors:
COL Mark Reynolds, MD [4]
MAJ (P) Tanja Roy, PhD, PT [4]
Cynthia Bush, MPH [2]
Esther Dada, MPH [1]
Shamola Dye, MPH [2]
Michelle Canham-Chervak, PhD [1]
Tyson Grier, MS [1]
Joseph Pierce, PhD[1]
Anna Schuh-Renner, PhD [1]
Bonnie Taylor, PhD [1]

Editorial Support:
Mimi Eng [1]
Audrey (Gail) Gibson [5]
Anne E. Quirin [6]

[1] Army Pubic Health Center (APHC), Directorate of Clinical Public Health and Epidemiology (CHPE), Injury Prevention Division (IPD)

[2] Cherokee Nations Technical Solutions, contracted to Armed Forces Health Surveillance Branch (AFHSB), Defense Health Agency (DHA) Epidemiology and Analysis (E&A) Section; US Army Satellite – Aberdeen Proving Ground (APG), MD

[3] General Dynamics Information Technology, Fairfax VA, contracted to AFHSB/DHA//Public Health Division/E&A.

[4] APHC CPHE

[5] APHC Publication Management Division (PMD) CPHE

[6] Contractor, NorthTide Group, LLC contracted to APHC PMD

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1 REFERENCES

Appendix A provides the references cited within this document.

2 PURPOSE

This document establishes a taxonomy for categorizing the full spectrum of injuries that may be included in public health monitoring and reporting. The taxonomy includes a framework with standardized definitions that are operationalized in terms of specifically assigned medical diagnostic codes according to the *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) (Centers for Disease Control and Prevention (CDC), 2017). This public health information paper is intended to promote the future standardization and comparability of public health epidemiologic efforts. As its focus is on physical injuries, behavioral and mental conditions are excluded.

3 INTRODUCTION

Though public health and military organizations have conducted injury surveillance for decades, the meaning of the term "injury" has evolved over time. In addition, different entities conducting studies at any given time appear to have defined it inconsistently. There does not appear to have ever been an officially documented definition of injury that links to internationally accepted medical diagnostic codes. This has presented a problem when attempting to compare results from different surveillance reports or epidemiological studies. The following subparagraphs provide background information that outlines the problem as it relates to the U.S. Army Public Health Center (APHC) Injury Prevention mission.

3.1 Background

3.1.1 Evolution of Injuries as a Public Health Problem

Public health can be described as "the collective efforts to assure the conditions in which a population can be healthy" (Institute of Medicine (IOM), 1988, 2002). One area of effort includes the prevention of injuries, as injuries have been described as one of the leading public health problems for decades. Yet clinical outcomes implied by the term "injuries" have evolved over time and can still vary depending on individual organizations' priorities (IOM, 1999; Rivara, 2001). Thus, the aim of this document is to provide the reader a taxonomy that operationally defines "injury" and provides a structure for categorizing the types of injuries being evaluated in injury epidemiology investigations.

Prior to and including the 1800s, U.S. culture largely considered injuries as "accidents or random or unavoidable consequences of human malevolence or carelessness" (IOM, 2002). During the Industrial Revolution, attention was drawn to risk factors associated with

occupational injuries in the mining, railroad, textile, and meatpacking industries. As toxicological sciences advanced, an increase in patent medicines led to numerous poisonings. Recognition of organizational strategies that could prevent injuries and poisonings led to the establishment of the first food and drug laws (1906), the National Safety Council (1913), and the U.S. Public Health Service (1914) (IOM, 2002; Klaassen and Amdur, 1996). In 1918, the Bureau of Labor Statistics (BLS) issued its first safety and health report, summarizing the frequency and severity of injuries in the steel and iron industries during the World War I period (BLS, 2016). Political, scientific, and social investments in injury prevention continued to expand to address worker, driver, child safety, and poison control efforts. Sentinel public health events that ensued included the establishment of the Highway Safety Act (1966), the American Trauma Society (1968), the Occupational Safety and Health Act (1970), the Consumer Product Safety Commission (1972), and the National Highway Traffic Safety Administration (1979) (IOM, 2002).

By the end of the 20th century, the National Academy of Science (NAS) had highlighted the importance of injury prevention in several major reports: *Injury in America* (1985); *Counting Injuries and Illnesses in the Workplace: Proposals for a Better System* (1987); *Injury Control* (1988); *Work-Related Musculoskeletal Disorders: A Review of the Evidence* (1998); and *Reducing the Burden of Injury: Advancing Prevention and Treatment* (1999) (National Institute for Occupational Safety and Health (NIOSH), 1989; National Research Council (NRC), 1985, 1998, 1999). The common theme throughout these reports, as described in the "*Proceedings of the International Collaborative Effort on Injury Statistics*" (CDC, 1995), was a continued emphasis on fatal injuries. Nationally, motor vehicles continued to be the leading cause of fatalities and, thus, remained a public health priority despite many successful prevention efforts already implemented (CDC, 1999). High numbers of fatalities also drew public health attention to firearm accidents, recreational vehicle mishaps, and severe seasonal heat and cold conditions (CDC, 1995, 2012; IOM, 1999, 2002). The concept of injury prevention was also expanded to "intentional injuries" defined as "purposeful human acts of violence directed at oneself or others, including suicide, homicide, and physical abuse" (IOM, 2002). Prevention of fatalities and extremely severe injuries in the workplace remained high priorities (BLS, 2016).

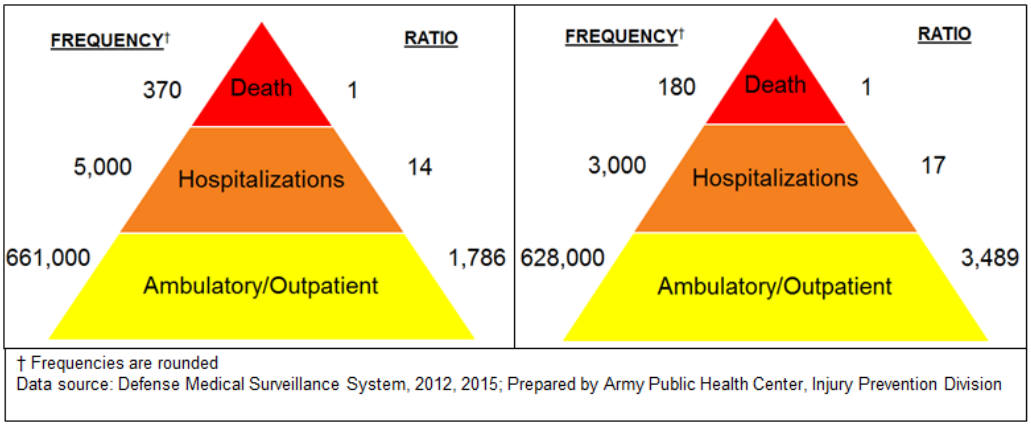
Despite the emphasis on fatalities, the public health community also began to acknowledge the impact of non-fatal conditions, such as traumatic brain injuries (Dawodu, 2007; Heyer and Franklin, 1994; IOM, 2006; Menon et al., 2010). Of even greater impact among working people, especially those in physically demanding occupations, has been the recognition of work-related musculoskeletal (MSK) injuries and chronic MSK "overuse disorders" (e.g., low back strain, tenosynovitis, and carpal tunnel syndrome) as leading causes of disability (NRC, 1998, 1999; NIOSH, 1997; Silverstein et al., 1997). Several MSK injuries and overuse conditions (such as Achilles tendonitis, stress fractures, knee pain) have also plagued athletes (DiFiori et al., 2014; Fredericson et al., 2006; IOM, 1998, 2007; Micheli and Jenkins, 1995; Noyes et al., 1988; Peterson and Renström, 1986). Many of these same MSK injuries have also been identified as a leading contributor to medical encounters among military populations (Bullock et al., 2010; Hauret et al., 2010; IOM, 1998; Jennings et al., 2008; Jones et al., 1993, 1989, 1999, 2010a, 2010b, 2015; Molloy et al., 2012; NRC, 2006; Ruscio et al., 2010).

Despite the sports medicine and military communities' long-time recognition that many MSK outcomes are preventable "overuse injuries," most of these are still not classified as "injuries" under the ICD coding system. Rather, the ICD system classifies the diagnoses for these

outcomes (e.g., Achilles tendonitis, stress fractures, back pain, carpal tunnel syndrome) under "Diseases of the MSK system and connective tissue." This broad class of diagnoses includes many MSK diseases and conditions that are either age-related or the result of non-modifiable genetic conditions or deformities. As a result, many injury epidemiologic studies and injury statistics still do not include many of these preventable MSK diagnoses as "injuries." This is problematic since they have been identified as the most significant medical burden to both U.S. civilian and military populations, impacting the health system, medical costs, lost job and training days, disability, and long-term quality of life (NIOSH, 1997; Weinstein et al., 2014; Marshall et al., 2014).

3.1.2 Army Injury Statistics

Similar to the civilian community, U.S. military and Army safety (non-combat) injury priorities are directed primarily at reducing fatalities (Department of Defense (DOD), 2011, 2014; Department of the Army (DA), 2011a). Fatal injuries are most frequently associated with motor vehicle accidents but also result from mishaps with equipment, aviation, and ammunition (DA, 2014, 2015, 2016; U.S. Army Combat Readiness Center (USACRC), 2016). In addition, to prevent severe and even fatal environmentally-related events such as heat stroke, specific policies and mandatory annual trainings are enforced (DA, 2003, 2005; Hauschild et al., 2016). Efforts to reduce Soldier fatalities have been successful. For example, only 127 non-battle or disease-related fatal injuries were reported by the Army safety community in 2015, a drop of 58 percent over 10 years (DA, 2015). Medical surveillance also indicates this reduction in fatalities: Figure 1 shows that the frequency of injury fatalities dropped 49 percent from 2012 to 2014.



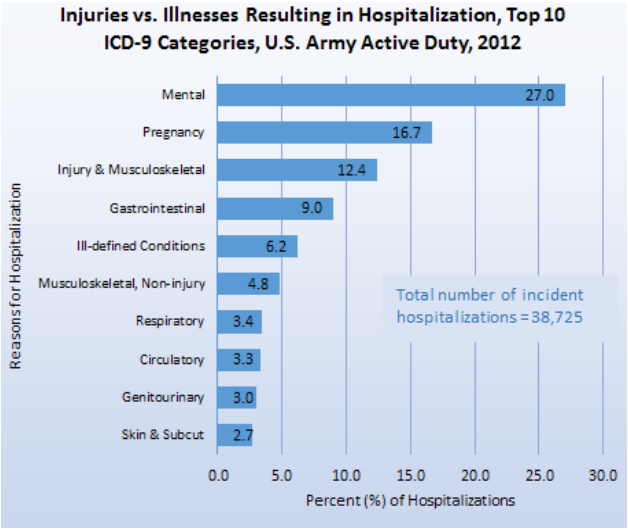
Sources: Marshall et al., 2014; Weinstein et al., 2014; APHC, 2015.

Figure 1. Injury Pyramid, Active Duty Army, 2012 and 2014

The reduction in Army fatalities is a noteworthy public health success. However, because every non-combat fatal injury is considered preventable, fatality prevention still remains a priority within the military.

Without discounting the need to continue to prevent fatalities, the impact of *non-fatal* injuries on the Army should also be recognized. As shown in Figure 1, for every death in 2012 there were approximately 1800 non-fatal injuries. The reduction in fatalities in 2015 emphasizes the continued problem of non-fatal injuries. Non-fatal injuries can require one or several outpatient visits, and they account for almost two million medical visits annually among all the U.S. Services (Marshall et al., 2014). These injuries also represent a substantial clinical impact on military health care, as well as the physical readiness of individual Soldiers and units. In 2006, the most common type of non-fatal military injury was lower-extremity MSK injury (e.g., stress fracture, Achilles tendonitis, plantar fasciitis, bursitis), which occurred at a rate of almost 900 per 1000 person-years. Medical encounters for this type of injury were 2.5 times greater than those for mental disorders, the next leading category of encounters (Jones et al., 2010a). Most non-fatal injuries were training-related and resulted from overuse.

An analysis of 2012 Active Duty Army data found that Soldiers had over one million medical encounters, i.e., hospitalizations (inpatient) and ambulatory care (outpatient clinic visits) that year. Injuries and injury-related MSK conditions were the third leading major diagnosis category associated with hospitalizations (Figure 2) behind mental illness and pregnancies (Marshall et al., 2014). Perhaps more importantly, ambulatory, i.e., outpatient clinic, injuries comprised the majority of the injury encounters. These outpatient injuries were predominantly MSK-related conditions such as fractures, joint dislocations, strains, and sprains (Figure 3) (Marshall et al., 2014).



Source: Marshall et al., 2014

Figure 2. Top 10 Army Active Duty Injuries and Illnesses Resulting in Hospitalization, 2012

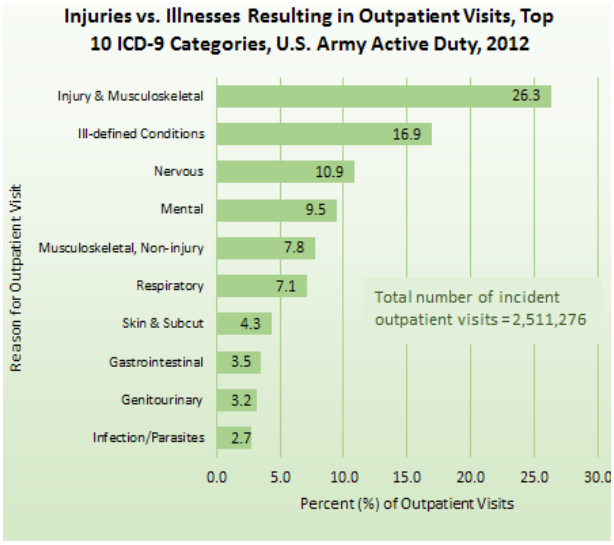


Figure 3. Top 10 Army Active Duty Injuries and Ilnesses Resulting in Outpatient Visits, 2012

In addition to clinical impact, MSK injuries are a leading cause of lost-duty days and medical disability and discharge (Lowe, 2013; Jennings et al., 2008; Molloy et al., 2012). Most physical injuries are caused by training regimens that can overstress the MSK system. For example, an

estimated 70 to 80 percent of the MSK injuries during Initial Military Training are considered to be the result of the repeated stresses on Soldiers' bodies during physical training. These injuries (referred to as "overuse" injuries) have also been estimated as the cause of more than half of the discharges among first-year recruits (Molloy et al., 2012). The NRC has highlighted these entry-level, training-related MSK injuries as "the single most significant medical impediment to military readiness" (NRC, 2006). MSK injuries resulting from sports and exercise are also the leading cause of medical evacuations for non-combat deployment injuries (Hauret et al., 2010). The full effect of MSK injuries is not just from the initial treatment or lost-duty time; recurrent or latent effects further impact military resources and readiness (Jennings et al., 2008; Lowe, 2013; Marshall et al., 2014; Molloy et al., 2012).

3.1.3 Army Public Health Center Injury Prevention Division

The APHC Injury Prevention Division (IPD) evaluates injury trends, conducts epidemiologic investigative studies, and collaborates on research studies to monitor the rates and characteristics of injuries among Active Duty Soldiers (DA, 2007). While Army safety goals focus primarily on fatalities, the IPD focuses on data related to non-fatal injuries to help identify primary prevention strategies (Jones et al., 2010; Ruscio et al., 2010). Because evidence has routinely demonstrated that high rates of injuries are attributed to training activities that repetitively stress the lower body (such as running and lengthy road marches), these activities have been a primary IPD focus (Bullock et al., 2010; Jones and Hauschild, 2015; Hauret et al., 2010; USAPHC, 2016; Jones et al., 1999; Ruscio et al., 2010).

Recent military surveillance data continue to show that the most frequent diagnoses (i.e., ICD-10-CM codes) for Active Duty personnel are for MSK conditions and MSK disorders for both men and women (*Medical Surveillance Monthly Report (MSMR)*, 2016). These include conditions such as stress fractures, runner's knee, and lower-back pain. Ample evidence demonstrates that many, and perhaps even most, of these MSK diagnoses are preventable since the injuries are often the result of excessive or inappropriate training programs. This is not surprising to many in the military health community (Hauret et al., 2010; Hauschild et al., 2016; Chalupa et al., 2016; Knapik et al., 2004, 2005, 2012). Army doctrine also describes the need to consider injury prevention when establishing and implementing training programs for Soldiers (DA, 2010b, 2011b).

The APHC IPD, in collaboration with the Armed Forces Health Surveillance Branch (AFHSB) of the Defense Health Agency (DHA), develops numerous injury reports and tools to aid installation and unit leaders in understanding the magnitude of their local injury problem and the types of injuries sustained by their Soldiers. Recent examples include the Health of The Force (HoF 2016) and APHC Active Duty and Civilian Installation Injury Reports (APHC 2017). The APHC Active Duty Installation Injury Reports are provided online through both the Strategic Management System (SMS) and Public Health 360 (PH360) and provide installations with metrics for their injury reduction goals. The IPD and AFHSB also routinely monitor select injuries at initial and advanced Army training sites (Knapik et al., 2006) to produce Training-Related Injury Reports (TRIR). These products continue to describe the significant impact of non-fatal MSK injuries.

The prevention of physical injuries is not a consistently-recognized or -applied Army priority (Hauschild et al., 2016). This is partly due to the confusion associated with defining injuries, and the resulting difficulty in comparing or deciphering reported data (Cryer and Langley, 2008; Langley and Brenner, 2004; Noyes et al., 1988; Roos and Marshall, 2014).

3.2 Medical Data Classification System

3.2.1 ICD

To conduct routine injury monitoring and surveillance-related analyses, the IPD primarily relies on medical encounter data from electronic health records. These data are provided by the AFSHB which maintains the Defense Medical Surveillance System (DMSS), a centralized data system for inpatient and outpatient medical encounters for U.S. military personnel.[1] Medical encounters in DMSS include standardized diagnosis codes from the ICD-9-CM (prior to 1 October 2015) and the ICD-10-CM (CDC, 2016). The ICD-10 is established and copyrighted by the World Health Organization (WHO, 2016), which authorizes its use by the U.S. and other governments. The U.S. Department of Health and Human Services (DHHS) guidance directs the use of the ICD-10-CM (a modification of the ICD-10 for use in the U.S.) through the CDC's National Center for Health Statistics (Hedegaard et al., 2016).

The ICD-10-CM is used to classify medical diagnoses into an alphanumeric code, which permits easy data storage, retrieval, and analysis. In the U.S., these codes are primarily used to determine the cost of provided medical care or for billing purposes. The codes are also used for medical surveillance and research, including analysis of the general health status of specific population groups (e.g., the U.S. military) and monitoring of the incidence and prevalence of diseases and other health problems in relation to other factors (WHO, 2016).

3.2.2 Recent Changes to ICD Codes

Effective October 1, 2015, the DHHS directed that ICD-9-CM codes be replaced by ICD-10-CM codes. Table 1 shows the organization of the ICD-10-CM classification system: 19 major categories, or "chapters," of primary diagnosis codes; a chapter of secondary external cause codes (e.g., "cause codes"); and a chapter for other medical encounters (e.g., health-screening visit). The 19 ICD-10-CM chapters provide nearly five times the number of codes (more than 68,000, up from approximately 13,000) with greater detail than the 17 chapters of codes in the previous version (Barta, 2008).

Most of the ICD-10-CM expansion occurred in Chapter 19, the "injuries" chapter (specifically, S- and T-codes). This chapter provides more than 43,000 injury codes compared to approximately 2,600 in ICD-9-CM (Hedegaard et al., 2016). Another substantial change is how the injury codes are structured. In ICD-9-CM, injuries to a specific body region ("800–899 series" diagnosis codes) were grouped according to the nature of the injury (e.g., fracture, open

[1] http://www.health.mil/Military-Health-Topics/Health-Readiness/Armed-Forces-Health-Surveillance-Branch/Data-Management-and-Technical-Support/Defense-Medical-Surveillance-System

wound), with sub-codes for body regions (e.g., head, upper extremities, and so forth). These are now ICD-10-CM S-code injuries that are grouped first by body region, then by nature of injury subcategories (Appendix B, Table B-1). The other Chapter 19 "injury codes" are T-codes (Table B-2), which largely expand on the ICD-9-CM 800–999 series of codes. The T-codes include injuries associated with multiple or unspecified body regions, poisonings, and certain consequences of external causes, such as frostbite, heatstroke, or burns.

Though not classified as "injuries" in ICD-9-CM (i.e., not included in the 800–999 series), the sports medicine and military medical communities have long recognized a portion of ICD-9-CM 700–799 series diagnoses as MSK injuries attributable to "overuse" that occurs during physical training activities (Hauret et al., 2010; Micheli and Jenkins, 1995). Previous military evaluations have shown that diagnoses with a subset of these codes (710–739) are more common than diagnoses with ICD-9-CM 800 and 900 series injury codes (Hauret et al., 2010; Marshall et al., 2014). These same types of MSK injuries are now primarily classified as M-codes (Table B-3) in ICD-10-CM, Chapter 13. Compared to the ICD-9-CM 710–739 codes, the ICD-10-CM M-codes are much more expansive and include many new and modified descriptions. Because the IPD routinely monitors "overuse injuries" and uses surveillance findings as the foundation for evaluating risk factors for injuries, the burden of injuries on the health care system and injury reduction initiatives, it is necessary to establish a complete and consistent operational definition of these injuries and their associated ICD-10-CM codes.

Table 1 provides a summary of the ICD-10-CM chapters and code series relative to prior ICD-9-CM chapters. The injury categories defined by this document are aligned with specific codes from various chapters, but primarily focus on Chapter 13 "M-codes" and Chapter 19 "S- and T-codes). Chapter 20 and 21 are not diagnostic codes so are not specifically addressed.

Table 1. Summary of ICD-10-CM Chapters and Code Series

Chapter [ICD-9]	Codes [ICD-9]	ICD-10 Chapter Title	Code type Δ
1 [1]	A00-B99 [001-139]	Certain infectious and parasitic diseases	Primary
2 [2]	C00-D49 [140-239]	Neoplasms	Primary
3 [4]	D50-D89 [230-289]	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Primary
4 [3]	E00-E89 [240-279]	Endocrine, nutritional and metabolic diseases	Primary
5 [5]	F01-F99 [290-319]	Mental, Behavioral and Neurodevelopmental disorders	Primary
6 [6]	G00-G99 [320-389]	Diseases of the nervous system	Primary
7 [6]	H00-H59 [320-389]	Diseases of the eye and adnexa	Primary
8 [6]	H60-H95 [320-389]	Diseases of the ear and mastoid process	Primary
9 [7]	I00-I99 [390-459]	Diseases of the circulatory system	Primary
10 [8]	J00-J99 [460-519]	Diseases of the respiratory system	Primary
11 [9]	K00-K95 [520-579]	Diseases of the digestive system	Primary
12 [12]	L00-L99 [680-709]	Diseases of the skin and subcutaneous tissue	Primary
13 [13] a	M00-M99 [710-739]	Diseases of the MSK system and connective tissue	Primary
14 [10]	N00-N99 [580-629]	Diseases of the genitourinary system	Primary
15 [11]	O00-O9A [630-679]	Pregnancy, childbirth and the puerperium	Primary
16 [15]	P00-P96 [760-779]	Certain conditions originating in the perinatal period	Primary
17 [14]	Q00-Q99 [740-759]	Congenital malformations, deformations and chromosomal abnormalities	Primary
18 [16]	R00-R99 [780-799]	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	Primary
19† [17] b, c, d	S00-T88† [800-999]	Injury, poisoning and certain other consequences of external causes	Primary
20 [19] e	V00-Y99 [E800-E999]	External causes of morbidity	Secondary
21 [18] f	Z00-Z99 [V01-V91]	Factors influencing health status and contact with health services	Other medical encounters

Notes: ΔPrimary indicates a diagnosis code; † indicates code series historically used for most "injuries."
[a] Though not labeled as "injuries," the M-codes link primarily to the prior ICD-9-CM 700 code series and include several MSK "overuse injuries" (DOD, 2002; Hauret et al., 2010).
[b] ICD-10-CM, Chapter 19 represents traditional "injury" codes reflected by the ICD-9-CM 800-999 series (Hedegaard et al., 2016).
[c] S-codes link primarily to the prior ICD-9-CM 800 code series but are more numerous and detailed, and group injuries by specific body site/regions (e.g., injuries to the head (S00-S09), injuries to the neck (S10-S19), and injuries to the thorax (S20-S29)) as opposed to the ICD-9-CM 800 series, which grouped injuries by type (e.g., fractures, dislocations, sprains, lacerations). Also new, the ICD-10-CM S-codes include extensions to note the initial encounter (A), versus subsequent encounters (D), or any sequela encounters (S) for conditions that arise as a result of the injury (Hedegaard et al., 2016).
[d] T-codes link primarily to the prior ICD-9-CM 900 code series and include poisonings, effects to unspecified body regions, and certain other consequences of specific external causes (e.g., heat, altitude).
[e] V/Y-codes are used secondary to a primary code and describe specific circumstances of the encounter.
[f] Z-codes are for medical encounters for other than a classifiable disease, injury or external cause, such as visits for routine examinations, vaccinations, organ or tissue donation, or blood typing.

3.2.3 ICD-10-CM Injury Codes Used in Routine Military Surveillance

For routine injury monitoring, the IPD obtains Soldier medical encounter data from AFHSB for all inpatient and outpatient encounters with specified injury diagnosis codes (ICD-9-CM or ICD-10-CM) for a specified timeframe. The previously established standard set of injury-related diagnosis codes used for IPD and the AFHSB injury surveillance and monitoring have served as the basis for the installation injury report (IIR). Though specific injury codes may be requested for unique projects, the IPD has used the IIR codes to prepare the annual Army injury reports and installation-specific injury reports. The TRIR addresses only the most common injuries (i.e., lower extremity and lower-back injuries) among trainees during Initial Entry Training (IET) (i.e., Basic Combat Training (BCT)) and Advanced Individual Training (AIT)) (e.g., at Fort Benning, Fort Jackson, Fort Leonard Wood, Fort Sill). The codes used to create the TRIR are based on a select subset of the original IIR codes (Knapik 2004, 2006).

As a result of the transition from ICD-9-CM to ICD-10-CM, the APHC IPD and AFHSB conducted a cross-walk between the ICD-9-CM IIR codes and the ICD-10-CM codes.[2] This was necessary to allow continuity of injury surveillance and monitoring efforts. Due to the complexity and expansion of the new ICD-10-CM codes, the IPD determined that a more refined evaluation of the injury diagnosis codes is necessary to capture and understand all injury data accurately. Documentation of the approach and rationale for definitions and selected codes needed to be transparent and provide a citable reference for future studies. Such a product would mitigate inconsistent definitions that can lead to under- or over- reporting, inappropriate comparisons among study findings, and/or misdirected prevention priorities.

[2] Information pertaining to AFHSB IIR injuries is provided under “Documentation” at http://www.health.mil/Military-Health-Topics/Health-Readiness/Armed-Forces-Health-Surveillance-Branch/Reports-and-Publications/Installation-Injury-Reports.

4 BASIS FOR THE INJURY DEFINITION AND TAXONOMY

The use of inconsistent injury definitions and associated ICD codes poses obstacles to the surveillance of injury trends, determination of risk factors, development of targeted interventions, evaluation of the effectiveness of interventions, and prioritization of prevention strategies (Cryer and Langley, 2008; Langley and Brenner, 2004; Noyes et al., 1988; Roos and Marshall, 2014; Timpka et al., 2014). To facilitate the success of these public health activities, a logical and transparent standardized framework for defining and categorizing injuries is needed. This framework needs to be supported by a broad definition inclusive of "all" injuries and needs to align specific medical diagnosis codes with categories of the various injury types. In the past, many injury epidemiological studies have strictly adhered to diagnoses in ICD-9-CM Chapter 17, "Injuries and poisonings." This approach has failed to capture many injuries (e.g., "overuse" injuries). Given the recent changes to the ICD medical coding system (ICD-10-CM), the IPD has taken the initiative to review past efforts (DOD, 2002; Hauret et al., 2010) and develop a standardized "taxonomy of injuries." The IPD contends that a taxonomy that is created from an all-encompassing definition of injury will improve injury classification reliability and, thus, the understanding of injury epidemiology.

4.1 Determining the Definition of "Injury"

This section describes the process, considerations, and resulting decisions of IPD subject matter experts (SMEs) when determining the initial conceptual "injury" definition. Because injuries can mean different things to different audiences, this first conceptual definition was the necessary foundation for categorizing the full spectrum of injuries. The IPD team represented scientific expertise in fields of epidemiology, preventive and occupational medicine, physical therapy, kinesiology, physiology, public health, environmental science, safety, and statistics.

4.1.1 Exclusion Criteria

The IPD subject matter experts (SMEs) began by establishing the following exclusion criteria:

- Behavioral, emotional, moral, and other psychological trauma.
- Illness or disease associated with infectious agents, genetic conditions, or normal degenerative aspects of aging not due to external energy transfer to tissues/organs.

4.1.2 Literature Review

The IPD next conducted a literature review of definitions for the terms "injury," "traumatic injury," and "overuse injury." The IPD evaluated existing definitions to identify commonalities, differences, and any unclear elements. Though it was not an extensive systematic review, there was no evidence to suggest the existence of a consistently applied definition of "injury." The IPD discovered several inconsistencies in definitions and terminology among the organizations and scientific entities that monitor, analyze, and report injury statistics (see examples in Appendix C, Table C-1). Topics related to existing injury definitions were organized as issues

pertaining to the physiological aspects of the "outcome" and characteristics regarding the "cause." These components are discussed in subparagraphs 4.1.3 and 4.1.3.1.

4.1.3 Outcomes (Physical Damage to the Body)

Most definitions of injury describe the outcome as "damage to a body or body tissues." This broad definition has been questioned for situations lacking actual tissue damage (e.g., when a foreign object must be removed from the nasal cavity) (Langley and Brenner, 2004). However, even in these situations, some form of tissue damage would be expected in the absence of intervention. In addition, though most definitions do not specify the type(s) of tissue(s) or body part(s), direct local tissue damage is often implied through examples (e.g., fractures, sprains and strains, lacerations to skin, wounds or punctures to organs, nerve pain). However, damage to body tissue may involve multiple sites, systems, or even system-wide disruption (e.g., burns, poisonings, or electrocution). Additional outcome characteristics—particularly "time to onset" and "severity"—were discussed.

4.1.3.1 Onset

Among injury definitions, the onset of the tissue damage described is not addressed consistently. Many existing definitions use terms such as "acute," "traumatic," "immediate," "sudden," or "instantaneous" to describe a clearly identifiable injury onset (e.g., a bone fracture from a fall, wounds from a car accident, or a skin laceration from a knife cut). Terms such as "gradual onset," "repeated or repetitive motion," and "non-traumatic" have historically been less frequently used to describe "injuries." For example, some organizations have used the terms "illness" or "disorders" to describe the conditions from repeated or gradual exposures (BLS, 2016; NIOSH, 1997, 2012a; Finch and Cook, 2014). A prior military effort (DOD, 2002) considered the use of the term "illness" as misleading and clarified that specific types of non-traumatic "repetitive strain," "gradual onset" conditions should in fact be considered "injuries." However, as previously noted, the sports medicine community has recognized "gradual onset" injuries as "overuse injuries" (Finch and Cook, 2014). Though many sources differentiate acute or instantaneous injuries from those that occur gradually, only one quantified timeframe was found during this review (Timpka et al., 2014). This timeframe (e.g., minutes, hours, days, or weeks) provides critical context for defining the full spectrum of injury outcomes.

This document is focused on defining initial onset or "index" injury incidents. These index injuries, especially those with a gradual onset, are sometimes confused with long-term effects (e.g., sequelae, repeat or recurrent, delayed, latent, and chronic or permanent effects) (Finch and Cook, 2014). An index injury (from either an instantaneous or gradual onset) requires some amount of limited physical activity, with or without specific medical treatment, and resolves in days or months with full recovery (i.e., body tissues have recovered full structural and functional integrity). Pain and interference with physical ability that persists for three months or more has been described as a chronic condition (Blyth et al., 2015).

The long-term effects or chronic conditions related to injuries can require repeated medical treatment and/or restricted activity over many years. Because of the significant impact of these effects and conditions, medical encounters for subsequent and long-term injury-related effects may need to be included in some analyses. For example, a study describing the *overall injury*

burden to the medical system should include codes for long-term injury-related effects as well as the new onset injuries.

Whether a long-term effect is related to an injury may not always be clear. For example, it may be difficult to determine whether certain diagnoses given during a medical encounter are for a new injury or for a subsequent or long-term effect that is related to a previous injury. A medical encounter may be a follow-up visit for a prior injury or for a different injury that has resulted from, for example, the change in range of motion or strength caused by a previous injury (e.g., Achilles tendonitis resulting from an acute ankle sprain injury) (Finch and Cook, 2014). In the general civilian population, many degenerative long-term effects are the result of aging and not caused by prior injury. Such conditions observed in a young athletic or military population are more likely injury-related. For example, degenerative age-related conditions (e.g., osteoarthritis or a degenerative joint disorder in the knee in a 65-year old with no prior knee injury) would be considered normal and, therefore, would *not* be considered an injury-related condition. However, the same diagnosis in a 25-year old Soldier is more likely an injury-related condition. Specific long-term effects from MSK injuries described by ICD-10-CM codes include the following:

- *Sequelae to an initial injury* are medical encounters noted as "sequela" visits (i.e., a seventh digit "S" with ICD-10-CM codes) for incident injuries (initial encounters). Examples include S07.1XXS, the sequela code for a crush injury to the skull; and M84.311S, the sequela code for a stress fracture of the right shoulder. In past (ICD-9-CM) coding, sequela to an injury would have been captured as separate diagnoses (e.g., post-traumatic headache, arthritis). While these latent, chronic, and recurrent conditions (discussed below) also have unique codes in the ICD-10-CM, the sequelae "S" indicator can be useful to indicate direct relationships to new onset incident injuries.

- *Recurrent conditions* are considered long-term MSK effects since these diagnoses refer to conditions attributable to an earlier tear or injury. Examples include recurrent dislocation of the shoulder (M24.41*) or subluxation of the patella (M22.1*). Though the "long-term effect" classification is suggested, an alternative view is that these diagnoses could be considered "new onset injuries" since the diagnoses themselves do not describe the original injury.

- *Degenerative conditions* are typically related to normal aging and wear in older adults. When such conditions are not expected in a particular population, they may be related to an index injury. For example, an intervertebral disc degeneration (M51.3*) in a 25-year old Soldier is not likely due to the normal aging process. This diagnosis may, therefore, be considered a long-term "injury-related" MSK effect.

- *Delayed, latent, or chronic effects* continue or begin to occur months or years after an exposure, even if no prior injury was medically recorded. Conditions requiring treatment for over three months have been suggested as a demarcation of these effects (Timpka et al., 2014). Examples include the development of chronic back or knee pain; or a chronic pulmonary condition resulting from exposure to a chemical substance or an occupational hazard (e.g., asbestos).

While calculations of the incidence of new index injury may not include long-term effects, their contribution to the overall burden of injuries (e.g., medical care and cost, lost duty, or restricted activity) is noteworthy.

4.1.3.2 Severity

Inconsistent descriptions of the severity of an injury also contribute to disparate analyses (Palmer-Green et al., 2013). Some organizations include fatalities, some limit injuries to "severe" non-fatal outcomes (CDC, 2007a), while others are more broad and describe injuries as an outcome of "exceeding the threshold for normal tissue activity." Others do not address severity at all (Rivara, 2001). Some definitions further qualify injury outcomes as those conditions that result in one or more medical encounters, days of restricted work or limited physical activity, disability, and/or self-reported levels of perceived physical pain (USACRC, 2016; Timpka et al., 2014).

When ICD-9-CM or ICD-10-CM codes are used to identify injuries in medical records, only those injuries that resulted in medical visits are captured. These visits to a medical provider (referred to as injury encounters) are often separated into hospitalizations (inpatient visits) and ambulatory (outpatient) visits. Hospital inpatient visits are generally considered to be more severe than outpatient visits. Fatalities may be included with these medical data; however, deaths that occur prior to medical treatment may not be captured as injuries.

Severity metrics (such as the number of restricted activity days or the level of perceived pain) are often not reported in the medical records. Self-reported surveys or other systems may collect data for these additional injury outcome metrics. Comparisons of injury rates derived from counts of medical visits with rates calculated from self-report surveys must consider these different outcome measures and how an "injury" is defined. For example, someone reporting an injury in a survey based on his/her perceived pain and self-restricted activity may not have sought medical treatment. A study of medical records would not have captured this data as an injury.

4.1.4 Exposures (The Transfer of Energy)

The classic epidemiologic triad describes a health outcome as the product of the interaction of the human host, an exposure (to an agent), and the environmental conditions or external factors that allow or promote the exposure (Gordis, 1996). This same epidemiologic triad applies when the outcome is injury (Figure 4).

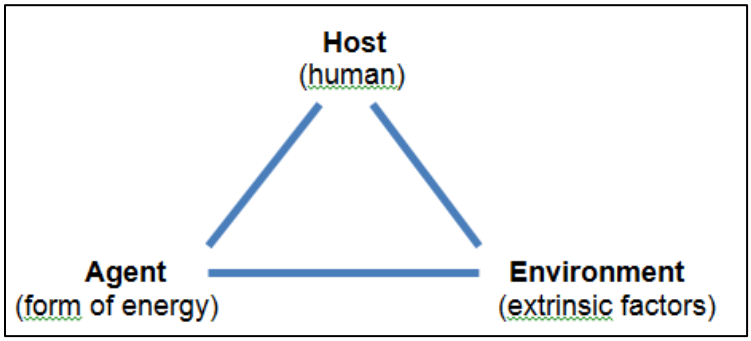


Figure 4. The Epidemiologic Triad Applied to Injury Outcomes

As described by Rivara (2001), a primary goal of epidemiology is to identify the cause of an adverse health outcome in a population. "Cause" is described as "an antecedent event, condition, or occurrence of the injury outcome at the moment it occurred, given that other conditions are fixed" (Rothman and Greenland, 2005). Existing definitions of injury commonly refer to the cause as "the transfer of an external energy to the body" (Haas et al., 2007; Langley and Brenner, 2004; *Mosby's Medical Dictionary (Mosby's)*, 2009; NIOSH, 2012b; Rivara, 2001). Therefore, cause can be described or categorized by the type of external energy involved. The nature of the exposure can be further characterized by other variables to identify and prioritize interventions. To some extent, such variables may be reflected by the type of medical diagnosis code. For example, some codes specify a type of intentional event (e.g., abuse), others describe damage resulting from the lack of an essential element (submersion), and some inherently refer to a specific source of energy (e.g., lightning). The following subparagraphs describe issues related to the types of exposure events that can lead to injury.

4.1.4.1 Types of energy

Energy can be categorized in several forms; the most prominent are mechanical, thermal (heat), radiant (light), nuclear (including radiological), electrical, and chemical (Table C-2). In most cases, it is the transfer of energy to the body that causes damage, but in some cases, it may be the absence of energy (cold temperatures) or essential elements (e.g., oxygen deprivation) that results in damage. The ICD-9-CM or ICD-10-CM external cause codes in medical records may provide additional details regarding the exposure event and extrinsic factors (e.g., activity, location) (Annest et al., 2014). However, healthcare providers, especially those in the military environment, do not always use these codes (Amoroso et al., 2000). When applied to electronic medical record surveillance, therefore, the taxonomy will be limited to the ICD diagnostic codes.

4.1.4.2 Intention

Some organizations separate injuries resulting from intentional acts (such as human acts of violence against oneself or another and those from unintentional (unplanned) acts (Haas et al., 2007; IOM, 2002). The previous DOD injury surveillance definition did not include "conditions occurring as a result of hostile fire, the direct action of an enemy, or hostile force or criminal acts where intent is known," though selected codes related to adult abuse were included(DOD, 2002). It can be difficult to ascertain the provider's intention from the diagnostic code; additional

codes are required to make this distinction. Because surveillance data and field investigations have historically demonstrated that physical training is the leading cause of non-fatal injuries, injury monitoring efforts have often been described as focusing on unintentional injury. This focus makes practical sense since intentional injury involves a different set of medical data and risk factors (primarily behavioral factors) (https://www.cdc.gov/nchs/data/ice/ice95v1/c35.pdf) and different prevention strategies addressed through the Army behavioral health community. For purposes of the recommended injury definition, intentionally caused injuries can be included as a physical injury because the "intention" behind an injury may not be known from a diagnosis code.

4.1.4.3 Absence of essential elements

The absence of heat can result in conditions such as frostbite. The absence of oxygen can result in asphyxiation or suffocation. Though some describe these conditions as injuries (Rivara, 2001), they are not consistently recognized as injuries or captured in injury surveillance. Admittedly, these exposure conditions are not caused by a transfer of external energy to the body. Indirectly, they may be described as the inhibition of a normal energy transfer between the body and the environment. To ensure that a definition of injury is inclusive of these scenarios (i.e., drowning, asphyxiation, frostbite), the absence of an essential element is included as an additional type of exposure.

4.1.4.4 Inanimate versus animate sources

External forces may be exerted by animate sources (e.g., humans, animals, insects, snakes) as well as inanimate sources (e.g., fires, radiation, or electricity). Injuries are included regardless of the source of the energy. The *type* of energy from these sources, however, can be varied. For example, the bite from a dog or non-venomous snake is a mechanical energy transfer injury. The injury from the bite of a venomous snake is from the injection of a poison that causes chemical changes in the body (chemical energy transfer). When humans are the cause of an injury, the exposure event may be intentional (e.g., suicide, gunshot, abuse to an adult or a child, poisoning), the result of an accident (e.g., motor vehicle, hit with a golf club, surgical mishap), or an unexpected reaction to a direct action (e.g., surgical complication). A specific individual form of energy transfer may be difficult to delineate in some of these situations.

4.1.4.5 Single versus repetitive exposures

"Sudden," "acute," and "traumatic" exposure incidents are common terms in injury definitions. As previously noted, these terms fail to capture injuries that result from the cumulative effect of exposure to a repetitive energy transfer. Though sometimes perceived as an "acute" occurrence due to sudden pain, the tissue damage from repetitive forces (e.g., stress fractures, tendonitis, synovitis, lumbar pain) occurs gradually. The NIOSH has described these conditions as work-related "MSK injuries" or "cumulative microtraumas," but it also refers to them as MSK disorders (NIOSH, 1989, 2012a). When attributed to physical training, the damage caused by cumulative microtraumas has been termed "overuse injuries" by the military and the sports medicine communities (Hoffman et al., 2015; Jones, et al., 2010; Micheli and Jenkins, 1995; Roos and Marshall, 2014).

4.1.4.6 The injury definition

Exhibit 1 presents the resulting definition of injury as applicable to this taxonomy.

Definition of Injury

Injury is the damage of or interruption to the normal functioning of body tissues that results when an energy transfer exposure exceeds the threshold of tissue tolerance either suddenly (acute traumatic injury) or gradually (cumulative microtraumatic injury). Exposures can be from—

- Unintentional (unplanned, uncontrolled) or Intentional (planned, violence-related) events.
- The transfer of energy (i.e., mechanical [including biomechanical], thermal (heat), light (radiant), nuclear [including ionizing or non-ionizing radiation], chemical, or electrical) from an external source OR from the absence of an essential element such as heat or oxygen.
- Animate (i.e., animals, insects) or inanimate (e.g., burns from a fire) sources.
- Single events or repetitive (cumulative) stresses.

Exhibit 1. Definition of Injury

4.2 Establishing the Taxonomy of Injuries

As previously described, injury statistics have historically been difficult to compare because a conceptual definition of "all injuries" has been lacking (Cryer and Langley, 2008; Langley and Brenner, 2004). The injury definition (presented in Exhibit 1) establishes this needed conceptual foundation. This definition limits the universe of medical conditions that constitute "injuries," and describes general causal exposure characteristics. Segregating injuries into different exposure categories and subcategories (as shown in Figure 5) can help direct prevention strategies. This "taxonomy of injuries" provides a standardized approach for defining injuries to promote consistency and allow appropriate comparisons between analyses. The types of injuries included in the various categories and subcategories are briefly described in the following subparagraphs.

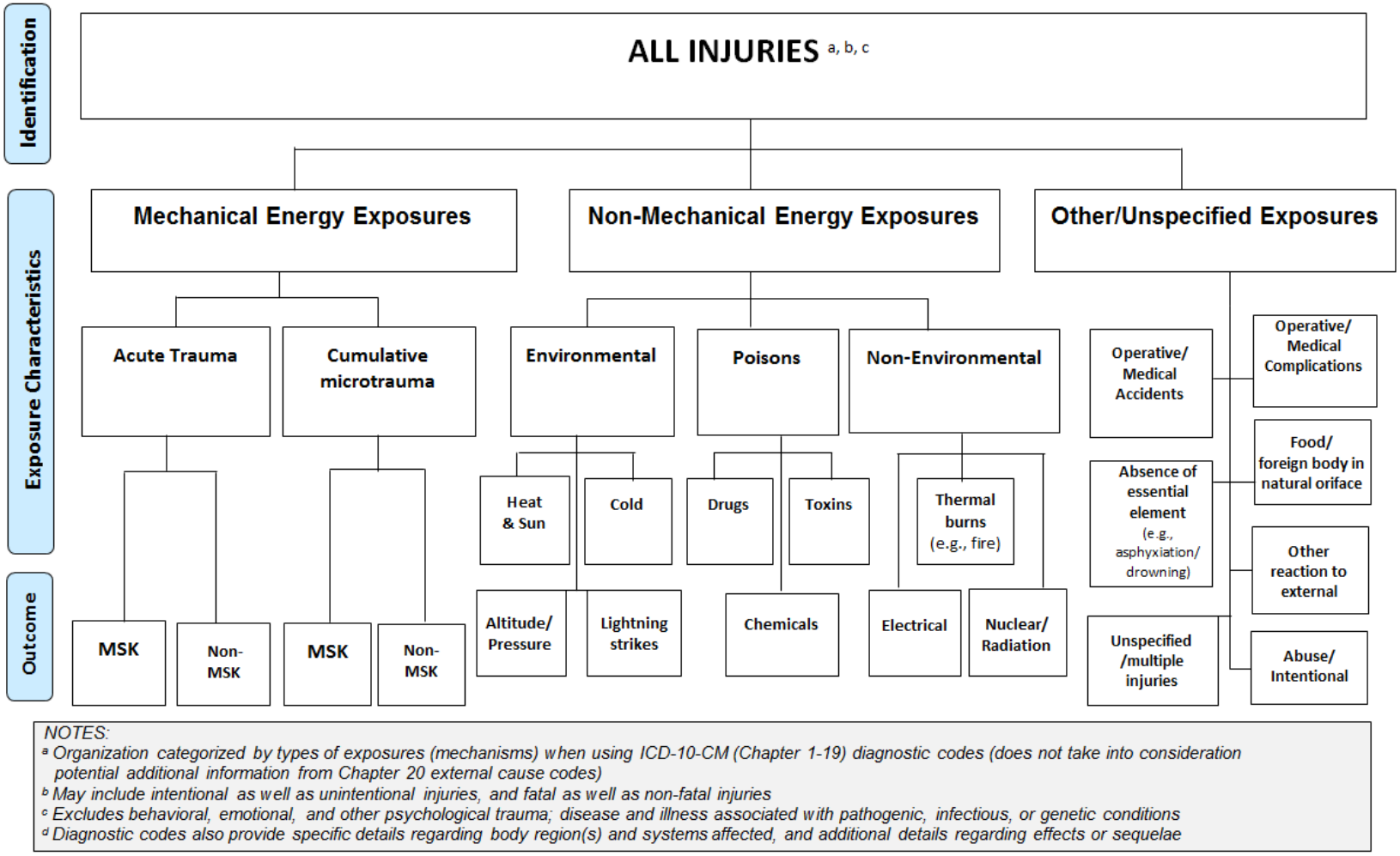


Figure 5. Taxonomy of Injury Flow Diagram

4.2.1 Mechanical Energy Exposures

As the *Handbook of Injury and Violence Prevention* (Haas et al., 2007) explains, most injuries result from the exchange of "mechanical energy" between the body and an object (including another person or the ground). Therefore, injuries resulting from mechanical energy are highlighted as a predominant category in the taxonomy. These mechanical energy transfers are subcategorized into two types of exposures: acute (traumatic) events and cumulative microtraumatic events.

In addition, it has been noted that the majority of injuries resulting from a mechanical energy transfer affect the MSK system (Hauret et al., 2010; Hoffman et al., 2015; Marshall, S.W. et al., 2014). Therefore, the taxonomy further separates both acute and cumulative mechanical injuries into sub-groups that reflect the different body systems injured. Injuries specific to the MSK system (bones, muscles, tendons, joints, ligaments, fascia, bursa) are grouped separately from injuries to other or multiple body systems (e.g., digestive, circulatory, nervous, respiratory, integumentary).

4.2.2 Non-Mechanical Energy Exposures

Because most injuries result from a mechanical energy transfer, injuries that result from the other forms of specific energy types were broadly grouped together and then further subcategorized. The subcategories include the following:

- *Environmental injuries* are caused by energies inherently present in the natural environment. Prevention of these types of injuries is supported by monitoring routine metrics for ambient conditions (e.g. temperature, humidity, barometric pressure) to help predict risk levels. This category includes injuries caused by exposures to weather-related thermal and radiant energy (heat stroke, heat exhaustion, sunburn) or the lack of such energy (cold injuries such as frostbite), altitude injuries (resulting from changes in pressure), and injury resulting from the electrical energy of a lightning strike.

- *Poisonings* result from the transfer of energy, including internal biological energy, caused by drugs, chemical substances, and toxins.

- *Non-environmental injuries* result from some of the same types of energy as environmental injuries, but the originating sources are man-made or not inherently natural, or may be less predictable or known. For example, thermal energy injuries in this category include burns from fires. This categorization does not separate fires that are man-made from those resulting from a natural occurring forest fire because the ICD-10-CM does not provide separate codes for these. This categorization includes electrical energy as it causes electrocutions other than those from lightning, and radiological injuries (a term used to refer to nuclear/atomic energy exposures) (Table C-2).

4.2.3 Other/Unspecified Exposures

Injuries from unspecified exposures or those that could not be grouped into one of the previous categories, e.g., asphyxiation (absence of oxygen, which could be caused by drowning or strangulation) and operative/surgical accidents or complications were captured in this category.

4.3 Operational Considerations

To operationalize the injury definition in surveillance and epidemiological studies, ICD-10-CM codes must be associated with it. The ICD-10-CM Chapter 19 classification system (S00-T88 Injury, poisoning and certain other consequences of external causes) influenced some of the decision-making pertaining to the taxonomy as long as a diagnosis could not definitively be excluded by the injury definition. For example, diagnoses listed under the "T-codes", including surgical complications and reactions to food, were included. Most notably, SMEs identified additional injury diagnoses from other ICD-10-CM chapters. The following sections of this document describe the specific ICD-10-CM diagnosis codes that are included under each of the various exposure categories and subcategories. Appendix D describes the recommended code groupings in this document as compared to those the AFHSB currently describes as military case definitions. Appendix E provides a summary of all the ICD-10-CM codes that are included in the injury definition and taxonomy.

The standardized list of ICD-10-CM injury codes will help minimize confusion during injury analysis and reporting. However, these codes alone do not establish a "case definition" for injuries. Other variables need to be factored into determining a case definition for specific products. For example, the incidence of new onset or index injuries often includes a set time period ("incidence rule"), such as excluding an injury visit that occurs within 60 days following the first medical encounter. The use of an incident rule, in addition to using only the initial encounter visits (such as those noted with an "A," "B," or "C" in the ICD-10-CM code), minimizes the over-counting of injuries that incur multiple medical visits. Self-reported data (survey responses) are another type of data not directly addressed by the technical definitions and ICD codes in this document. Studies that use self-report surveys to identify the incidence of new onset injuries are limited in that they are likely to underestimate the number of injuries due to recall bias. On the other hand, surveys that ask respondents to note 'any injury that resulted in restricted activity' may overestimate the medical burden, since not all of these injuries result in a medical encounter. Despite these limitations, there is an increasing reliance on survey data to collect more detailed injury information. Survey data are especially useful if they can be linked to injury data in medical records. Therefore, to the extent feasible and without being overly technical, surveys used to collect injury data should be oriented toward the definitions in this document.

Limitations and example application of the recommended codes and categories are described at the end of this document (sections 8 and 9).

5 INJURIES FROM MECHANICAL ENERGY EXPOSURES

As previously noted, injuries are most often attributed to mechanical energy transfer (Haas et al., 2007; Rivara, 2001). Mechanical energy is the sum of the *kinetic* and *potential* energy attributed to a source (Jain, 2009). When the kinetic energy (energy of movement or motion) is transferred to the body with enough force, it damages or destroys cells and tissues. Injury occurs when the damage interrupts proper body system or organ function or structure (exceeds the threshold for normal tissue function). The force required to cause injury may be described as either a high-intensity force or a low-intensity repeated force. Individual body systems (e.g., MSK) or multiple systems may be damaged by these forces. The basis for the different categories and subcategories of mechanical injuries is described in the following subparagraphs.

5.1 High-Intensity Forces

A high-intensity force will cause instantaneous damage to the body or body tissues. Examples include a twisted ankle from stepping off a curb, a broken bone from falling off a ladder, multiple wounds from a car accident, or a gunshot (BLS, 2016; CDC, 2007b; DOD, 2002, 2016; Haas et al., 2007; Hedegaard et al., 2016; *Mosby's*, 2009; NIOSH, 2012b, 2014; *Dorland's*, 2007; Timpka et al., 2014; U.S. National Library of Medicine, 2016; WHO, 2016). These are *acute traumatic injuries*. Acute trauma often occurs in a localized body region or type of tissue, such as that caused by lifting a heavy object with an awkward posture and straining one's back. In other cases, the mechanical energy may be dispersed and result in injuries to different body regions and systems. For example, a car accident could result in fractured bones in multiple extremities, lacerations, and a concussion.

5.2 Lower-Intensity Repetitive Forces

The literature describes cumulative microtraumatic damage to the body from repeated lower intensity (submaximal) forces. Some minor damage (such as to bone or muscle tissue from running, intense physical activity, and exercise) can actually promote tissue remodeling and strengthen MSK tissues over time if properly controlled in magnitude and frequency (Fredericson et al., 2006). When the amount and/or frequency of the force become too excessive, the microtraumatic damage accumulates to a point that the tissues can no longer repair or remodel themselves properly. For example, excessive running can cause repeated microtraumatic damage that can lead to an overuse injury such as a stress fracture to otherwise healthy bone (Clarsen, 2015; IOM, 1998). These cumulative microtraumatic injuries are primarily localized (involving a single body region) and most often involve the MSK system. The body region injured is most often associated with a specific physical activity or series of activities that are required for a specific job or sport. For instance, many assembly line activities and administrative computer jobs have been cited as the cause of carpal tunnel syndrome, while postal carriers have been found to have relative high rates of shoulder and neck pain (NIOSH, 1997). Military personnel have especially high rates of injuries from the constant repetitive forces to their lower extremities as a result of running, foot marching, and other on-foot physical training drills (Jones et al., 2010a).

5.3 Musculoskeletal Versus Non-Musculoskeletal Systems

As mentioned previously, a large portion of the injuries from mechanical energy transfer involve the MSK system (Hauret et al., 2010; Jones et al., 1999; Marshall et al., 2014). Therefore, injuries resulting from mechanical energy transfer (both from acute trauma and overuse) are further subcategorized into MSK and non-MSK injuries. The application of the taxonomy to current data will help determine the magnitude of differences among injuries to each system. In some cases, the evaluation of MSK injuries (such as overuse injuries in physical training or occupational settings) may need to include certain neuro-MSK diagnoses (identified by some of the ICD-10-CM “G-series” codes) as well.

5.4 Mechanical Energy Injuries and Subcategories

Exhibit 2 provides the definition of injuries resulting from mechanical energy exposures. For prevention purposes, this category of injuries can be further segregated into the subcategories of acute traumatic injuries and cumulative microtraumatic injuries. These subcategories are defined in the subparagraphs following Exhibit 2.

Mechanical Energy Injury

Definition:
The damage or interruption to the normal functioning of body tissues that results from an overload of kinetic energy that exceeds the threshold of tissue tolerance either suddenly, i.e., in less than one second, known as "acute traumatic injury"; or gradually, i.e., over minutes, hours, days, or weeks, known as "cumulative microtraumatic" or "overuse" injury.

MSK tissues affected: bone, cartilage, muscle, tendon, fascia, joint, ligament, bursa, synovium

Examples:

- Bone — Fractured femur, pelvic stress fracture
- Cartilage — Torn cartilage or meniscal tear
- Tendon — Tendonitis
- Muscle — Low-back muscle strain,[1] ruptured pectoralis major muscle
- Joint — Sprained ankle
- Ligament — Anterior cruciate ligament (ACL) tear
- Bursa — Bursitis
- Synovium — Synovitis

Non-MSK tissues affected[2]: integumentary, nervous, circulatory, respiratory, other organs

Examples:

- Integumentary (skin, nails) — Superficial wounds, lacerations; blisters
- Nervous[1] (brain, spinal cord, nerves, sensory organs) — Brain, eye, ear injuries
- Circulatory (heart, veins, arteries) — Wound/puncture to heart/artery
- Respiratory (lungs, trachea) — Punctured/crushed lung
- Other (digestive, excretory, reproductive, immune, endocrine) — Internal organ injury, foreign body, external constriction

[1] In some cases associated with pain, the specific system damaged may not be known/correctly documented; for example, damage may be either to a muscle or joint (MSK), the nerves, or both.
[2] Mechanical injuries to multiple systems or body regions may be grouped as non-MSK if a primary tissue or system is described; in addition, some codes describing unspecified or whole body injuries (such as T07, T14) are captured in the "Other/Unspecified" injury category.

Exhibit 2. Definition of Mechanical Energy Injury

5.4.1 Acute Traumatic Injuries from Mechanical Energy Exposures

Acute traumatic injuries are the most recognized types of injuries. They are distinguished by single brief exposure events that cause instantaneous damage or interruption to the function of a body system or organ. Acute traumatic injuries in the taxonomy are limited to those caused by mechanical energy. Acute traumatic injuries can result from intentional or unintentional

energy transfer from either animate or inanimate sources. Though *non-mechanical energy transfers* (e.g., heatstroke, electrocution, consumption of a poison, bite from a venous snake or insect) may be considered "acute incidents," these types of injuries are not included in this category. These non-mechanical and other taxonomy categories are discussed in subsequent sections of this document.

5.4.1.1 Acute traumatic injury definition

Acute traumatic injuries are sometimes assumed to be "severe" medical conditions (such as fractures or open wounds requiring surgical intervention). However, "acute" refers to the suddenness of the mechanical force and damage it causes, not the severity of tissue damage. For example, acute traumatic injuries can include minor lacerations and bruises. Exhibit 3 provides the definition of acute mechanical injury and specific examples.

5.4.1.2 Operational considerations

Table 2 summarizes the acute traumatic injury ICD-10-CM codes pertaining to mechanical energy exposures. The first column describes diagnoses that pertain to the MSK system; the second column lists the diagnosis codes that represent damage to non-MSK systems or multiple systems. Almost all of the ICD-10-CM S-codes are included in the acute trauma injury classification. A few T-codes are also included; however, most T-codes are the result of non-mechanical energy exposures and are grouped in the non-mechanical and other taxonomy categories discussed in subsequent sections of this document. In addition to the S-codes that reflect injuries to the eye (captured under codes for non-MSK system diagnoses), traumatic eye injuries of military interest also include some H-codes (AFHSB, 2016; Hilber et al., 2010). The H-codes for eye injuries included in this list reflect the recent recommendations of an internal APHC SME (see Appendix D). The M-codes listed in Table 2 are considered to be more indicative of and/or more frequently used by military providers for "acute trauma incidents" than for cumulative trauma/overuse injuries. Most of the acute traumatic injury codes listed in Table 2 also include extensions that providers use to indicate specific anatomical body regions or details of effects. For example, codes to identify initial medical encounters (for incidence) may include 7th-digit extensions such as "A." Follow-up visits (7th-digit extensions such as "D" or "R") or sequelae (7th-digit extension "S") may be useful for assessing the overall burden of care required for these injuries.

Acute Traumatic Injury (Mechanical Energy)

Definition:
The damage or interruption to the normal functioning of body tissues that results from a sudden, single high intensity overload of kinetic energy that exceeds the threshold of tissue tolerance.

MSK tissues affected: bone, cartilage, muscle, tendon, fascia, joint, ligament, bursa, synovium

Examples (ICD-10-CM code):

- Arm — Broken wrist (carpal fracture) (S62.10)
  Subluxation of shoulder (initial encounter) (S43.08)[1]
- Leg — Fractured tibia (S82.1)
  Strained muscle or tendon in leg (S86.2, unspecified injury to muscle or tendon)
- Knee — Dislocation or subluxation of patella (S83.0*)[1],
  Internal derange of the knee M23.1)[1]
  Sprain of ACL (S83.5)
- Ankle — Sprained ankle (S93.40)
- Back — Muscle strain in back (acute) (S39.012)

Non-MSK tissues affected: integumentary, nervous,[2] circulatory, respiratory, other organs

Examples (ICD-10-CM code):

- Head — Concussion (S06.0), Traumatic brain injury (S06.2)
- Ear — Traumatic rupture of ear drum (S09.2)
- Eye — Injury to eye or foreign body in eye (e.g., S05, T15)
- Nose — Superficial contusion of the nose (S00.33)
- Hand — Laceration on hand (S61.41); Bite wound to finger (S61.15*)
- Chest — Injury to lung without fracture (S27.89X*)
- Spine[2] — Injury to spinal cord in lower back (S34.1*)

* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)

[1] Some ICD-10-CM codes (e.g., for joint dislocation, torn ligaments, derangement of meniscus) are considered predominantly acute injuries when used in military medical records but may also be used to document long-term (i.e., recurrent, chronic) effects (examples are noted with "L" in Table 2).

[2] In some cases associated with "pain," the specific system damaged may not be known/correctly documented (e.g., damage may be either to a muscle or joint (MSK), the nerves, or both).

Exhibit 3. Definition of Acute Traumatic Injury

Table 2. Acute Traumatic Injury (Mechanical Energy) ICD-10-CM Codes[a]

ICD-10-CM Code Series	Acute MSK Injury Codes[b]	Acute Non-MSK Injury Codes[c]
G-Codes (*select codes for acute nerve damage and pain from trauma*)	--	*G44.311, .319 acute post trauma headache* *G56.1*,.2*, .3 specified nerve lesions* *G57.0*, .1*, .3*, .4*, .6* spec. nerve lesions* *G58.911 Acute pain due to trauma*
H-Codes *(select traumatic ocular injuries, see Appendix D)*	--	*H05.23*, H18.2*, H18.8*, H21.0*, .5*, H26.1*, H27.1*, H31.3*, H33.03, .04, H43.1*, H44.0*
K-Codes (i.e., broken tooth)	--	*K08.1*, .4**
M-Codes[b]		
M05-M14 Inflammatory polyarthropathies *M12.5 Traumatic arthropathy*	*M12.5***	--
M20-M25 Other joint disorders *M20 Acquired deformities of fingers, toes* *M23 Internal derangement of knee[L][b]* *M24 Other specific joint derangements[L][b]* *M25 Other joint disorder, NEC [not otherwise classified]*	*M20.011, .012 Mallet* *M20.019, .023 Boutonniere* *M23.3* Other mensc derang [L][b]* *M23.6* Oth spont disrupt, ligmt [L][b]* *M24.8* Oth joint derangmnt [L][b]* *M24.9* Joint derangmnt, unsp [L][b]* *M25.0* Hermathrosis* *M25.4* Effusion*	--
M45-M49 Spondylopathies *M48 Other spondylopathies*	*M48.3* Traum. spondylopathy*	--
M65-M67 Disorders of synovium/ tendon *M66 Spontaneous rupture: synovium /tendon*	*M66.1* Rupture synovium* *M66.2*, .3*, .8* spont rupt tendon*	--
M95 Oth disorder, MSK sys & connective tissue	--	*M95.1* Cauliflower ear*
S- Codes[d]		
S00-S09 Injuries to the head	*S02Δ (and except S02.5), S03.0,.4,.8,.9, S07, S09.1*	*S00-01,S02.5, S03.1-2, S04-S06, S08,S09.0,.2-.9*
S10-S19 Injuries to the neck	*S12Δ, S13, S16-S18*	*S10-S11, S14, S15, S19.8-.9*
S20-S29 Injuries to the thorax	*S22Δ, S23, S28.0-.1, S29.0*	*S20-S21, S24–S27, S28.2, S29.8*
S30-S39 Injuries to abdomen, lower back, lumbar spine, pelvis, external genitals	*S32Δ, S33, S36-S35, S39.0*	*S30-S31, S34-S38, S39.8-.9*
S40-S49 Injuries to the shoulder, upper arm	*S42Δ, S43, S46-S48, S49.0-.1*	*S40-S41, S44, S45, S49.8-.9*
S50-S59 Injuries to the elbow and forearm	*S52Δ, S53, S56-S58, S59.0-.2*	*S50-S51, S54, S55, S59.8-.9*
S60-S69 Injuries to the wrist, hand and fingers	*S62Δ, S63, S66-S68*	*S60-S61, S64, S65, S69.8-.9*
S70-S79 Injuries to the hip and thigh	*S72Δ, S73, S76-S78, S79.0-.1*	*S70-S71, S74, S75, S79.8-.9*
S80-S89 Injuries to the knee and lower leg	*S82Δ, S83, S86-S88 S89.0-.3*	*S80-S81, S84, S785, S89.8-.9*
S90-S99 Injuries to the ankle and foot	*S92Δ, S93, S96-S98*	*S90-S91, S94, S95, S99.8-.9*
ICD-10-CM Code Series	**Acute MSK Injury Codesb**	**Acute Non-MSK Injury Codesc**
T-Codes[e]		
T15-T19 Foreign body in body/body part	--	*T15-T19 (eye, ear, nasal orifices and pharynx)*

ICD-10-CM Code Series	Acute MSK Injury Codes[b]	Acute Non-MSK Injury Codes[c]
T79-T79 Other consequences of trauma	*T79.6XX, Traum. ischemia muscle*	*T79.* compartment syndrome (traumatic) (not including T79.6)*

Notes:
* Symbol used as a placeholder for all ICD-10-CM extension codes after preceding digit
∆ These exclude the friction blisters indicated in Table 3, cumulative trauma non-MSK injuries
[a] OPERATIONAL NOTES: When collecting data, only billable code numbers should be used. ICD-10-CM codes are 3–7 characters; the code "number" listed includes the highest level (e.g., least number of characters) needed for inclusion in a category/subcategory of the taxonomy. Sub-codes (i.e., codes with ≥4 characters) provide additional specificity. Some sub-codes are not included as an injury or are placed in a different category of the taxonomy.
[b] Even though official ICD guidance indicates certain M-code diagnoses should exclude current injuries, it is not enforced. Use of several M-codes in the military medical system, therefore, is predominantly considered to reflect a new injury (e.g., recent damage to joint/ligament/ cartilage) especially if described as spontaneous or traumatic. However, some of these M-codes could also be used for cumulative or long-term effects (noted with [L]).
[c] Non-MSK injury, including damage to teeth, cartilage in ear/ nose, inner ear bones (not structural MSK tissues), superficial and open wounds (including non-venomous bite wounds), nerve/spinal cord injuries (Sx4.xx), blood vessel injuries, and injuries to unspecified tissue.
[d] All S-codes are included except non-thermal or chemical blisters, which are presumed to occur primarily as a result of friction to tissue. The S-codes may also be associated with V/Y-codes that provide additional information regarding cause.
[e] Other T-codes are grouped in other energy transfer categories (e.g., environmental, poisonings), or are in "Other/Unspecified Injuries" of the taxonomy (i.e., T07, T14 unspecified/multiple injuries, and T80-88, operative/surgical mishaps).

5.4.2 Cumulative Microtraumatic Injuries from Mechanical Energy Exposures

A cumulative microtraumatic injury is a type of mechanical injury characterized by a repeated mechanical energy exposure over time. Some occupational organizations refer to these injuries as illnesses (BLS, 2016) or cumulative trauma disorders (NIOSH, 2012a). Because the damage results from an external mechanical energy transfer, regardless of the time exposed to the energy source, these diagnoses can also be defined as injuries. This application of the injury terminology is supported by the sports medicine (Clarsen and Bahr, 2014; Timpka et al., 2014) and military (DOD, 2002; Hauret et al., 2010) communities' increasing use of "overuse injury," "gradual-onset injury," and "repetitive microtraumatic injuries." The recognition that these diagnoses represent preventable conditions is critical to injury prevention surveillance.

5.4.2.1 Cumulative microtraumatic injury definition

Though existing terminology consistently describes the onset of cumulative microtraumatic injuries as "gradual," a more definitive explanation of the timeframe has been missing. Including a descriptive timeframe helps to distinguish these injuries from instantaneous acute trauma injuries, especially since it provides a greater window of opportunity in which to mitigate injury outcome. Timpka et al. (2014) suggested that gradual onset refers to a range from minutes to months. With this frame of reference, injuries ranging from friction blisters (which may occur after less than an hour of exposure) to stress fractures (from weeks or months of exposure) are included in this category. Exhibit 4 provides the definition of mechanical cumulative microtraumatic (overuse) injury along with specific examples.

Cumulative Microtraumatic Injury (Mechanical Energy)[1,2]

Definition:

The damage or interruption to the normal functioning of body tissues that results from the cumulative overload of a repeated low-intensity force that gradually exceeds the threshold of tissue tolerance over minutes, hours, days, or weeks.

MSK tissues affected: bone, cartilage, muscle, tendon, fascia, joint, ligament, bursa, synovium

Examples (ICD-10-CM code):

- Low back pain, dorsalgia (M54.5)
- Stress fracture (M84.3* [*indicates digits for specific sites, e.g., pelvic, hip (M84.35), tibia (M84.36)])
- Achilles tendonitis (M76.6) (other tendonitis under M76.*)
- Synovitis and tenosynovitis (M65.8*)
- Knee pain, "runners knee," as "Patellofemoral disorders" (M22.2*)
- Plantar fasciitis (M72.2)
- Metatarsalgia (foot pain and numbness) (M77.4)
- Bursitis (M70.1- .7)
- Rhabdomyolysis, non-traumatic (M62.82) (use T79.6XX for traumatic rhabdomyolysis)

Non-MSK tissues affected: integumentary, nervous, circulatory, respiratory, other organs):

Examples (ICD-10-CM code):

- Friction blister (SX0.*2, e.g., foot blister S90.82)
- Carpal tunnel syndrome (G56.0*)
- Brachial plexus disorders, e.g. rucksack palsy (G54.0)
- Effects of vibration (T75.2)
- Noise-induced hearing injuries of a non-traumatic nature (e.g., H83.3)

* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)

[1] Sports and military communities often refer to these as "overuse" injuries; occupational communities describe some of these as ergonomic-, occupational-, or chronic work-related injuries or conditions.

[2] Though sometimes described as sports or physical training-related injuries, these do not include the acute trauma injuries associated with sports or physical training.

Exhibit 4. Definition of Cumulative Microtraumatic Injury

5.4.2.2 Operational considerations

Table 3 summarizes the specific ICD-10-CM codes that represent mechanical cumulative microtraumatic injuries. The first column lists codes for injuries to the MSK system, and the second column lists those to non-MSK or multiple systems. Many of these diagnostic codes include extensions that indicate specific anatomical body regions and details of effects. These include select M-codes and a few S-codes (such as for friction blisters); T-codes; and selected G -codes for damage to the nervous system. H-codes and an R-code have also been included for noise-induced hearing injuries (NIHI), which are of specific interest to the military and have been captured in routine injury surveillance (AFHSB, 2016). Some of the S-, G-, and H-codes

may be associated with secondary external cause codes which provide additional detail about the exposure conditions or causal event.

Medical providers may use some of the MSK M-codes to document acute injuries, but internal APHC SMEs indicate that these codes are most often used for documenting cumulative microtraumatic injuries.

Table 3. Cumulative Microtraumatic Injury (Mechanical Energy) ICD-10-CM Codes[a]

ICD-10-CM Code Series	MSK	Non-MSK[d]
G-Codes	*IMPORTANT: Only selected sub-codes are included*	
G54 Nerve root and plexus disorders	--	*G54.0 Brachial plexus,* *G54.1 Lumbrosacr plex disorders* *G56.0 Carpal tunnel syndrome* *G56.8*, .9* mononrpthy, upper lmb*
G56-G57 Mononeuropathies (upper and lower limb)		*G57.1 Meralgia paresthetica* *G57.5 tarsal tunnel syndrome* *G57.8*, .9* mononrpthy, lower limb*
H-Codes	--	*H83.3* Noise effects inner ear* *H90.Sensorineurl hearing loss* *H93.1Tinnitus*
M-Codes	*IMPORTANT: Only selected sub-codes are included*	
M22 Disorder of patella [L][b]	*M22.2* Patellfrml disorders* *M22.4* Chondromalacia patellae* *M22.8* Other disorders patella* *M22.9* Unspec patella*	--
M24 Other specific joint derangements	*M24. 2* disorder.ligament*	--
M25 Other joint disorder, NEC [not otherwise classified]	*M25.5* Pain in joint* *M25.8* Other spec joint disorder*	--
M45-M49 Spondylopathies *[L][b]*	*M48.4* fatigue fracture,vertebra*	
M50-M54 Other dorsopathies*[L][b, c]* *M50 Cervical disc disorders[c]* *M51 Thoracic, etc disc disorders[c]* *M53 Other and unspecified dorsopathies, NEC[c]* *M54 Dorsalgia (back pain)[c]*	*M50.* [L][b]* *M51.1*, .2*, .8* [L][b]* *M53.1 Cervicobrachial syndr* *M53.8*, .9 Dorsopathy [L][b]* *M54.2 Cervacalgia* *M54.4* Lumbago w sctca [L][b]* *M54.5 Low back pain [L]* *M54.6 Pain in thoracic spine*	*M54.1* Radiculopathy* *M54.3* Sciatica [L][b]*

ICD-10-CM Code Series	MSK	Non-MSK[d]
	M54.8 , .9 dosalgia	
M60-M63 Disorders of muscles *M60 Myositis* *M62 Other disorders of muscle*	*M60.8* Other myositis* *M62.1* Rupt muscl non traumatic* *M62.8 Rhabdomyolysis*	--
M65-M67 Disorders of synovium and tendon *M65 Synovitis and tenosynovitis* *M67 Other disorders of synovium and tendon*	*M65.3* Trigger finger[L][b]* *M65.4 Radial sty. tenosyn.* *M65.8* Other syn/ten* *M67.5* Plica syndrome*	--
M70-M79 Other soft tissue disorders *M70 Soft tissue disorders from use, overuse, pressure*	*M70.03* Crepitant synovitis [L][b]* *M70.1* - .7* Bursitis* *M70.8* -.9* Other soft tissue*	--
M71 Other bursopathies	*M71.5* other bursitis* *M71.8* other bursopathies*	--
M72 Fibroblastic disorders	*M72.2 Plantar fascial fibromtsis*	
M75 Shoulder lesions	*M75.1* Rotr cuff tear nontrm [L][b]* *M75.2* Bicipital tendinitis* *M75.3* Calcific tendinitis [L][b]* *M75.4* Impngmnt shoulder synd* *M75.5* Buristis of shoulder*	--
M76 Enthesopathies, lower limb, excluding foot ([L][b]	*M76.0*, .1* spec. tendinitis* *M76.2* Iliac crest spur* *M76.3* Illiotibia lband syndr* *M76.4* Tibial collateral bursitis* *M76.5* Patellar tendinititis* *M76.6* Achilles tendinitis* *M76.7* Peroneal tendinitis* *M76.8* tibial tendonitis* *M79.9 Unsepc enthes*	--
M77 Other enthesopathies	*M77.0*, .1*. .5* epicondylitis* *M77.3*Calcaneal spur* *M77.4* Metatarsalgia*	--
M79 Other and unspecified soft tissue disorders, NEC[c]	*M79.1 Myalgia* *M79.6* Pain in (hand,*	*M79.2* Neuralgia and neuritis*

ICD-10-CM Code Series	MSK	Non-MSK[d]
	foot, etc) *M79.A Nontraum compart synd* *M79.9 Other*	
R-Series	--	*R94.120 Abnormal aud fxn study*
S-Code Series		
S00-S09 Injuries to the head	--	*S00.*2* (non-thermal) blister*
S10-S19 Injuries to the neck	--	*S10.*2* (non-thermal) blister*
S20-S29 Injuries to the thorax	--	*S20.*2* (non-thermal) blister*
S30-S39 Injuries to abdomen, lower back, lumbar spine, pelvis, external genitals	--	*S30.*2* (non-thermal) blister*
S40-S49 Injuries to the shoulder and upper arm	--	*S40.*2* (non-thermal) blister*
S50-S59 Injuries to the elbow and forearm	--	*S50.*2* (non-thermal) blister*
S60-S69 Injuries to the wrist, hand and fingers	--	*S60.*2* (non-thermal) blister*
S70-S79 Injuries to the hip and thigh	--	*S70.*2* (non-thermal) blister*
S80-S89 Injuries to the knee and lower leg	--	*S80.*2* (non-thermal) blister*
S90-S99 Injuries to the ankle and foot	--	*S90.*2* (non-thermal) blister*
T-Code Series		
T79-T79 Certain early complications due to trauma	--	*T75.2* Effects of vibration*

Notes:
* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)
[a] OPERATIONAL NOTES: When collecting data, only billable code numbers should be used unless otherwise specified by a study. ICD-10-CM codes are 3-7 characters; the code "number" listed in this document includes the highest level (least characters) needed for inclusion in a category/subcategory of the taxonomy. Sub-codes (i.e., codes with ≥4 characters) provide additional specificity. Some of these sub-codes are not included in the injury definition or are placed in a different category of the taxonomy.
[b] Even if ICD note indicates an M-code is to exclude current injuries, use of this code in the military medical system is currently considered to predominantly reflect new onset injury; however, some codes [L] could also be used for long-term effects.
[c] Back pain conditions involve the nervous system but are grouped with MSK due to relationship with specific MSK structural tissue.
[d] Non-MSK injury: includes damage to inner ear/ear bones (not structural MSK tissues), superficial skin friction injury (blisters, Sx0.x2x), specific nerve-related injuries (G-series).

6 INJURIES FROM NON-MECHANICAL ENERGY EXPOSURES

The Army trains and conducts its mission in a variety of environments/terrains that can expose personnel to numerous non-mechanical external hazards and conditions that increase the risk of injury. The resultant injury types and characteristics these non-mechanical energy sources may present are quite varied. For the IPD taxonomy, specific injuries from non-mechanical energy sources were grouped into three subcategories: environmental, poisons, and other.

6.1 Environmental Injuries

An injury is categorized as "environmental" if the natural, ambient environmental conditions are directly related to the injury diagnosis (ICD-10-CM code). Energy exposures include thermal (e.g., heat from sun), radiant (e.g., sun rays), and electrical (e.g., a lightning strike). Cold-related injuries are also included; these represent ambient conditions where there is inadequate energy for proper tissue functioning, or energy is transferred from the body to the environment.

Environmental injuries may affect only one type of tissue (i.e., skin) or may impact multiple body systems simultaneously. They may result from a single and sudden event (e.g., lightning strike) or a cumulative exposure of minutes, hours, or more (e.g., sunburn, heat stroke, frostbite). Metrics for the hazards (e.g., temperature, pressure) are measured to assess and manage the risks of these injuries. Though only a very small percentage of Army injury incidents (Jones et al., 2010), environmental injuries can be fatal. They also represent unique concerns in military populations, especially during training or deployment to locations with extreme climate/weather and altitude conditions. Prevention of these injuries is specifically addressed in military regulations and doctrinal guidance. For example, heat-related injuries (such as heat stroke and heat exhaustion) are DoD reportable medical events (RMEs) (DA, 2003; DA, 2007) and are addressed during annual seasonal training (DA, 2003, DA, 2010b). Other environmental injuries addressed by specific doctrine include cold weather injuries (DA, 2005) and altitude-related injuries (DA, 2010a).

Most environmental injuries are included in the T-code section (Chapter 19) of the ICD-10-CM. These diagnosis codes, sometimes described as "combination codes," provide information pertaining to the injury's effect as well as any contributing environmental factors (e.g., T33-34 codes for frostbite) (Hedegaard et al., 2016). However, in some cases (e.g., radiation sickness), exposure can be associated with either a natural source or man-made structures or equipment. For purposes of the taxonomy, these are grouped with non-environmental injuries that result from a non-mechanical energy transfer.

There are also ICD-10-CM diagnosis codes that can not only represent injuries associated with an environmental exposure but can also represent non-injury conditions from non-environmental causes or contributing factors. For example, Army high altitude training doctrine (DA, 2010a) defines several conditions that may occur during high altitude training or operations (e.g., high altitude cerebral edema, high altitude pulmonary edema, and altitude-induced peripheral edema). Though the military assigns the descriptive "high altitude" names, the applicable ICD-10-CM diagnosis codes describe them more generically (e.g., G93.6, cerebral edema). Because these conditions may not always be injuries specific to an environmental condition, they are not included in the current injury definition. However, they may need to be factored into detailed injury analyses if the external cause codes or patient history indicates that the diagnoses were attributed to environmental exposures. The definition of environmental injury and specific examples are provided in Exhibit 5.

Environmental Injury

Definition:

The damage or interruption to the normal functioning of body tissues that results from a transfer of non-mechanical energy (i.e., thermal, radiant, electromagnetic) or the absence of a necessary energy (e.g., thermal energy), when the exposure is associated with a specific natural (non-man made) condition or hazard (i.e., weather-related conditions or altitude).

Examples (ICD-10-CM code):

- **Heat- and Sun-related injury:** Heat stroke (T67.0), Sunburn (L55.*)
- **Altitude/Pressure:** Other effects of high altitude (e.g., mountain sickness, T70.2), Decompression illness (T70.3), Otitic barotrauma (T70.0)
- **Cold:** Frostbite (T33-34), Hypothermia (T68X), Immersion (trench foot, T69.0), Chilblains (69.1)
- **Lightning:** Effects of lightning (T75.0*)

* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)

Exhibit 5. Definition of Environmental Injury

6.2 Injury from Poisons

The science of toxicology (study of poisons) is without question an important facet of public health (Klaassen and Amdur, 1996). The inclusion of poisonings as a category of injuries, however, has not been uniformly embraced. Because the primary ICD-10-CM classification for injuries (Chapter 19 “Injury, poisoning and certain other consequences of external causes”) includes poisonings (WHO, 2016), they are sometimes classified as a type of injury in medical surveillance. Some poisons will directly damage body tissues by the transfer of chemical energy. Others may not cause their effect by an obvious or direct transfer of energy. These poisons include substances that have metabolic or systemic mechanisms of action at a molecular level. However, just as food is metabolized to produce energy, transfers of chemical and thermal energies at a molecular level can disrupt normal tissue function. Therefore, and as a matter of convention with the ICD-10-CM Chapter 19 and reporting by the CDC (CDC, 2007b), poisoning codes are included in this taxonomy as a subcategory of non-mechanical injury.

Almost any substance has the potential to produce injury (or death) in sufficient quantity, and therefore may be a poison. The term “poison” is used to describe a broad range of natural and manufactured substances, including chemicals and toxins (Klaassen and Amdur, 1996; *Dorland’s*, 2007). Specific broad categories include chemicals, drugs, and toxins. Chemicals or chemical compounds include inorganic (e.g., cyanide or arsenic) and organic (e.g., alcohol, solvents, corrosives, respiratory irritants, pesticides, mustard gas, chlorine) poisons. Drugs and medications include chemicals produced for medicinal or recreational consumption purposes. Toxins are naturally produced within living organisms. Common types of toxins include neurotoxins (e.g., from black widow spiders and scorpions), cytotoxins (from plants, e.g., ricin), and mycotoxins (from fungi). Many specific substances or types of substances commonly associated with injuries identified by the ICD-10-CM can be grouped under one of these subcategories of poisons.

Poisons may be intentionally or unintentionally introduced to the body through ingestion, injection, inhalation, or contact and are usually absorbed through the gut, skin, or respiratory tract. Poisonings can cause damage or interruption to body system(s) when the exposure is a single sudden event (e.g., skin contact with a corrosive acid, ingestion of a fatal dose of cyanide, injection with ricin, inhalation of phosgene gas) or when it is gradual, from repeated events over a longer duration of time (ingestion of lead or arsenic, inhalation of chlorine). The severity of damage from a poison is often associated with the dose or amount, the route, as well as the duration and/or frequency of absorption. Outcomes (e.g., cancer) that are associated with chronic chemical exposures (e.g., daily exposure for years) are not typically considered injuries. However, a diagnosis attributed to a specific chemical exposure may meet the injury definition provided by this document. For example, respiratory diagnoses attributed to specific external substances (e.g., dust, silica, asbestos) are included in the taxonomy. Respiratory or other health conditions that are not linked to a specific known chemical or toxic substance exposure event, however, are not considered injuries.

A large portion of the medical diagnostic codes that fall into the ICD-10-CM "Poisoning" series are for *adverse effects* that result from an unexpected reaction to a medicinal substance (e.g., an allergic reaction or development of disease symptoms from a vaccine) or for effects resulting from the "*under-dosing*" of medications (e.g., a seizure from inadequate insulin). Consistent with the recommendation of the CDC (Hedegaard et al., 2016), these are not included in the injury taxonomy.

Exhibit 6 provides the definition of poisoning injuries.

Poisoning Injury[†]

Definition:

The damage or interruption to the normal functioning of body tissues that results from the introduction of a foreign/exogenous substance to the body through ingestion, injection, inhalation, or contact that causes a chemical reaction at a molecular or cellular level. Substances may be natural or synthetic and include—

- **Drugs:** chemical substances produced for medicinal or recreational applications.
- **Chemicals:** inorganic (e.g., cyanide, arsenic, silica) and organic (e.g., pesticides, solvents, and corrosives, toxic gases such as chlorine) substances produced for non-medicinal applications.
- **Toxins:** organic poisons produced within living organisms (including animals [snakes, shellfish], insects, plants, bacteria, and fungi).

Examples (ICD-10-CM code):

Drugs:
- **Injection:** Poisoning by insulin (T38.2*)
- **Ingestion:** Alcohol poisoning (e.g., T51.91)
- **Other:** Ototoxic hearing loss (H91.0)

Chemicals
- **Ingestion:** Cyanide (T65.0X1)
- **Inhalation:** Carbon monoxide (T58), Toxic gases/fumes (J68.3)
- **Contact:** Corrosive chemical (T23, T30.4, T32, T54.94)

Toxins
- **Ingestion:** Food contaminated by aflatoxin (T64)
- **Injection:** Venomous snake bite (T63.0), black widow spider bite (T63.3)

---

* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)

† EXCLUDED:
- Conditions/diseases not shown to have been directly caused by a specific poisoning incident (single or gradual).
- Unexpected adverse reaction to a medicinal substance (e.g., *Adverse effect of antibiotic, accidental (T36.91X)).*
- Effects from the "under-dosing" of medications (e.g., a seizure resulting from inadequate insulin).

Exhibit 6. Definition of Poisoning Injury

6.3 Injuries from Non-Environmental, Non-Mechanical Energy Exposures

The conceptual definition of injury includes conditions where damage to the body may be caused by electricity, fires, or radiation sources that are not attributed to the natural environment. For example, the correct diagnosis code for electrocution caused by a lightning strike is T75.0, which is categorized as an environmental injury. The code T75.4, which is for an electrocution without a specified source, is captured under the non-environmental subcategory. On the other hand, codes for "burns" (codes within T20-T32) do not specify an originating source of the burn source. The IC-10-CM codes do not differentiate among burns that could result from a hot stove or from fires started by a lightning strike, arson, or through carelessness (e.g., failure to extinguish a campfire). For this reason, "burns" are captured as a subgroup in the non-environmental injury subcategory.

Exhibit 7 provides the definition and examples of non-environmental electrical, thermal, and radiological injuries.

Non-Environmental (Thermal Burns, Electrical, and Nuclear/Radiation) Injury

Definition:

The damage or interruption to the normal functioning of body tissues that results from the exchange of thermal, electrical, or nuclear (ionizing or non-ionizing) energies that are not exposures attributed to natural environmental conditions.

Examples (ICD-10-CM code):

- **Thermal (burns, fire):** Burns of eye (T26.4), Burns involving 50% body surface (T31.5*)
- **Electrical:** Electrocution (T75.4)
- **Radiation:** Radiation sickness (source unspecified, T66.X)

* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)

Exhibit 7. Definition of Non-Environmental (Thermal, Electrical, and Nuclear/Radiation) Injury

6.4 Operational Considerations

Table 4 summarizes the ICD-10-CM codes that represent injuries from each of the non-mechanical energy exposure categories (environmental, poisons, and non-environmental). Though not included in the standard injury definition, additional diagnostic codes, as well as secondary external cause codes, are provided for use in detailed evaluation of these non-mechanical injuries when narrative data and/or cause codes are used.

Table 4. Non-Mechanical Energy Injury ICD-10-CM Codes

ICD 10 Codes	**Environmental** (Heat/Light, Altitude/Pressure, Cold, Electrical)	**Poisons** (Drugs, Chemicals, Toxins)	**Non-Environmental** (Thermal, Electrical, Radiological)
E-Codes	*E87.1 Hyponatremia*	--	--
H-Codes	*H16.1 (Photokeratitis - e.g., snow blindness) H31.029 solar retinopathy*	--	--
J-Codes			
J60-J70 Lung diseases due to external agents [a]	--	*J68-J70* [a]	
L-Codes	*L55 Sunburn L74.0. .3 Milaria*	**--**	**--**
T-Codes			

ICD 10 Codes	**Environmental** (Heat/Light, Altitude/Pressure, Cold, Electrical)	**Poisons** (Drugs, Chemicals, Toxins)	**Non-Environmental** (Thermal, Electrical, Radiological)
T20-T25 Burns and corrosions of external body surface, specified by site T26-T28 Burns and corrosions confined to eye and internal organs T30-T32 Burns and corrosions of multiple and unspecified body regions	--	*(Corrosions)* *T2(0-5).*4* -9** *T26.x5x -9x* *T27.*4* -9** *T28.*5* -9** *T30.4* *T32*	*(Burns)* *T2(0-5).x0x -3x* *T2(6, 8). 0* - 4** *T27.x0x -3x* *T28.x0x -4x* *T30.0* *T31*
T33-T34 Frostbite	*T33-T34 (all)*	--	--
T36-T50 Poisoning by medicaments/biological substance; *excludes* "adverse effect of under-dosing of drugs"	--	*T36-T50.**4* *(with exclusion)*	--
T51-T65 Toxic effects of substances chiefly non-medicinal as to source (e.g., chemicals, toxins/venomous animals and plants)	--	*T51-T65*	--
T66-T75 Other/unspecified effects of external causes: *T66 Radiation sickness, unspecified* *T67 Effects of heat and light* *T68 Hypothermia* *T69 Other effects of reduced temperature* *T70 Effects of air pressure and water pressure* *T75 Other/unspecified effects*	 *T67 (all)* *T68.X* *T69.0*, .1* (trench foot)* *T70* (altitude illness)* *T75.0 (lightning)* *T75.8*	--	 *T66.X, Radiation sickness* *T75.4X, Electrocution*
Additional diagnosis codes not considered "injury" but may be included in specific studies:			
D75.1 Secondary polycythemia	D75.1 (hypoxemic)	--	--
External cause codes for possible use in specific studies of applicable environmental injury codes:			
W94 Exposure to high/low air pressure, pressure change	*W94*	--	*W94*
X31 Exposure to excessive natural cold	*X31*	--	--
X37 Blizzard	*X37*	--	--
X83.2 Intentional self-harm by exposure to extreme cold	*X83.2*	--	--
X30 Exposure to excessive natural heat	*X30*	--	--
X32 Exposure to sunlight	*X32*	--	--

Notes:
* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)
[a] Codes listed are considered to present as short- or near-term effects after exposure(s) to a chemical or foreign substance (e.g., particulate). Other respiratory conditions resulting from tissue damage caused by a specific external agent *(silica, dusts, metal particulate, chemical*) are delayed for months to several years (e.g., berylliosis, asbestosis). These conditions (ICD-10-CM codes J60-J67.9) are often associated with unique occupational exposures and are considered long-term effects.

7 INJURIES FROM OTHER OR UNSPECIFIED EXPOSURES

7.1 Other Events Resulting in Injury

Some medical diagnostic codes describe a condition or event that indicates a transfer of energy or inherently implies an injury but does not meet the criteria of the established categories. Such codes are used when the exposures were unspecified, multiple types of exposures and injuries were involved, or the exposures were not definitively defined among the subcategories. "Injuries from other or unspecified exposures" include injuries resulting from complications of surgery, asphyxiation (from strangulation or drowning), deprivation, neglect, and abuse. While these are not expected to comprise large numbers of the overall injuries treated by the U.S. Army, the evidence required to support such an assumption has not been obtained. Further, because some of these injuries may be preventable, their evaluation in focused studies may be necessary.

Exhibit 8 provides the definition and examples of injuries resulting from other or unspecified exposures.

Injuries from Other or Unspecified Exposures

Definition:

The damage or interruption to the normal functioning of body tissues that results from exposures that are unspecified or not previously defined (i.e., multiple/unspecified injuries, post-operative accidents and complications, absence of needed element/energy, abuse/neglect; foreign body in natural orifice, or reaction to other external energy source).

Examples (ICD-10-CM code):

- **Multiple/Unspecified body regions** (T07, T14.8, T14.9, T75.89X)
- **Operative/Post-Operative accidents:** Foreign body accidentally left in body (T81.5)
- **Operative/Post-Operative complications:** Surgical complications or reactions (T80.8)
- **Absence of essential element(s) or energy:** Asphyxiation/strangulation/smothered (T71), exhaustion due to excessive exertion (T73.3), starvation (T73.0X), submersion, e.g., drowning (T75.1)
- **Abuse/neglect:** Adult sexual abuse (T74.2, T76.2)
- **Foreign body in gastric, alimentary, respiratory, genitourinary tract**: Object in esophagus causing injury (T18.128)
- **Anaphylactic reaction to an external cause**: Dairy products (T78.07X)

Exhibit 8. Definition of Injuries for Other or Unspecified Exposures

7.2 Operational Considerations

Table 5 summarizes the general ICD-10-CM codes included in this category. (Extension codes will provide additional detail regarding exposure and/or outcome.)

Table 5. Injuries from Other/Unspecified Exposures, ICD-10-CM Codes

Code Series	Specific selected codes
T-Code Series	
T07-T07: Injuries involving multiple body regions	*T07*
T14-T14: Injury of unspecified body region	*T14 (includes injury due to suicide attempts)*
T71-T78: Other/unspecified effects of external causes:	*T71 Asphyxiation* *T73† Effects of other deprivation (starvation, water deprivation, exhaustion due to exposure, exhaustion due to excessive exertion)* *T74 Adult and child abuse, neglect and other maltreatment, confirmed* *T75.1 Unspecified effects of drowning and submersion* *T76 Adult/ child abuse, neglect/other maltreatment, suspected* *T78 Adverse effects, not elsewhere classified*
T79: Certain early complications of trauma, NEC	*T79* ***EXCEPT for*** *T79.A (Traumatic compartment syndrome) and T79.6 (Traumatic ischemia of muscle) (these two are acute mechanical MSK injuries)*
T80-T88: Complications of surgical and medical care, NEC	*T80-T88* *Codes separated into those describing "accidents" foreign body left in body during surgery versus unplanned reactions and "complications"*
† NOTE: Use of T73 codes needs to be further evaluated. Some codes may be placed in a different category (e.g., "exhaustion due to excessive exertion" may be used mostly for heat-related illness)	

8 LIMITATIONS OF THE INJURY TAXONOMY AND DEFINITIONS

Consider the following primary limitations when applying the taxonomy and its associated definitions.

8.1 Injury Categories May Need to be Separated or Merged for Specific Studies

Situations that require unique subsets of diagnosis codes from one or more categories are inevitable. In some cases, "all injuries" or even a defined category of injuries may not meet the specific objectives of a particular study. For example, a study of injuries among recruits or trainees may need to include mechanical injuries of the MSK system, environmental heat-related illnesses, and a subset of other injuries known to occur during physical training (e.g., certain nerve-related injuries, exertional compartment syndrome, or rhabdomyolysis (*MSMR*, 2012) that are not included in the established categories. In that case, an investigator should clearly define any subset of MSK and non-MSK injuries, as well as acute versus overuse injuries, included in the study.

8.2 Not All Injury Studies Use Medical Records or ICD-10-CM Codes

When researching medical records prior to 2015, an investigator would need to reconcile the ICD-9-CM codes with this taxonomy and its category definitions. An increasing number of studies rely on self-report surveys, instead of medical diagnosis codes, to identify injuries. In

such studies, the specific ICD-10-CM codes assigned to injury categories in this document will not be useful. However, comparisons between injury rates from ICD-10-CM codes and those based on self-reported surveys should reflect common elements. Any major differences expected to impact injury rates should be documented. For example, investigators using self-report survey data must decide whether to include injuries that did not result in medical treatment. As noted by Clarson et al. (2013), persons may not seek medical treatment for certain injuries that cause them to restrict their activity or work time. Loss-time as a measure to define injury incidence, as well as severity, has been found to be a particularly useful metric. However, use of this definition would be expected to result in a much higher rate compared with rates derived from medical visits (Clarson, 2013). Investigators can use these taxonomy and category definitions when developing survey questions to identify and categorize injuries but should attempt to align definitions with those provided by this taxonomy. Appendix F provides an example of potential survey questions.

8.3 Injuries May Be Miscoded or Misclassified

Medical providers and trained coders may occasionally code injuries incorrectly or may assign diagnosis codes that are so general that the type and cause of injury cannot be classified according to the taxonomy. For example, the type of energy transfer attributed to “pain in joint” or “pain in leg” is difficult to assign. In these cases, selection and grouping of ICD-10-CM diagnoses for this taxonomy were based on a “majority rule” determined by clinical and non-clinical IPD SMEs. It was assumed that in the majority of instances, the diagnosis code would be used to reflect the injury category to which the code has been grouped. Because data are inadequate to quantify “majority,” the IPD used a consensus process for subjectively determining whether the majority achieved was 51 percent or greater. In many cases, it was difficult to identify a single diagnostic code that best fit a particular type of injury. For example, the terminology “shin splints” has previously been described as a common overuse injury among military personnel. Unfortunately, this condition, a stress reaction between the muscle and tibia bone, can be diagnosed several ways. For example, it may be diagnosed as an acute condition when it occurs or is noted suddenly (e.g., S86.892, Other injury of other muscles and tendons at lower leg; S86,911-919, Strain of unspecified muscles and tendons at lower leg level; or S89.891, Unspecified injury of lower leg), or it may be diagnosed as a cumulative microtraumatic injury (e.g., M84.361-2, Stress fracture to tibia; M76.81, Anterior tibial syndrome; M76.82, Posterior tibial tendinitis; M76.89, other specified enthesopathies of unspecified lower limb, excluding foot). Despite the coding variability, this condition is considered an overuse injury (that would precede a stress fracture if further exposure is not prevented). In other situations, it is hypothesized that some M-codes describing cumulative or long-term effects may be used for documenting incident acute traumatic injuries (in place of S-codes) because coding of M-codes is easier/less time-consuming (does not require external cause codes).

8.4 ICD-10-CM Codes Alone Do Not Establish a Case Definition

This document focuses on defining categories of injuries and identifying associated medical codes. It does not establish a complete “case definition,” which requires operational decisions to apply to the data source. A case definition is needed for all studies and surveillance reports, even when they provide simple descriptive counts. One operational decision is the number of diagnosis codes to be captured for a study. Medical records can contain several diagnoses

codes for a single encounter. Use of the first listed diagnosis code, often referred to as the "primary diagnosis," is an example of a common operational decision. However, some studies may use four or more (all) listed diagnoses. Studies and reports should document the decision and rationale. The type of incidence rule, another necessary operational decision, is needed to avoid overestimating injuries that are seen repeatedly during multiple medical encounters. A common approach has been to apply a "60-day rule" so multiple visits with the same ICD code in a given time period are counted only once. The 60-day rule has variations, however. For example, there is a difference between a 60-day "incident rule" and a 60-day "gap rule" (see 8.5). In addition, the 60-day rule may not always be applied to the same ICD code extension digit. An ICD-10-CM diagnosis can have a definitive billable code with as few as four digits and as many and six digits. The 60-day rule could be applied to only the first four digits in all cases, or the full six (when they exist). No case definition may suit all studies; however, Table 6 presents an example of a methodological approach and case definitions for incident injuries as well as for follow-up and long-term effects. Regardless of the set of operational decisions, injuries may be both over- and underestimated

8.5 Injury Codes Do Not Address Long-Term Effects

This document provides a definition for new onset (i.e., incident or novel) injuries. The inclusion of long-term effects that may be associated with an injury is also important when representing the overall burden of injury (Richmond et al., 2013). For studies that address this overall injury burden, the follow-up and sequelae medical encounters for the new onset injuries (e.g. initial encounters, column 1 of Table 6) described by the taxonomy should be included in the data collection and analysis (column 2 of Table 6). In addition, there are additional long-term effect medical diagnoses that should be included. As an example, column 3 of Table 6 describes additional ICD-10-CM codes for MSK long-term effects/conditions that may need to be included when estimating codes or costs related to overall MSK injury burden. Other chronic MSK and non-MSK conditions may also be of interest in particular studies. The codes for these describe medical encounters only. Economic studies would also need to include procedure codes, such as physical therapy rehabilitation codes (F-codes), to estimate costs.

Table 6. Example: Determining Burden of MSK Injuries and Related Long Term Effects

STEP 1 Identify New Onset Injuries[a]	STEP 2 Follow-up & Sequela	STEP 3 Identify Additional MSK Injury-related Long-term Effects[b] (for initial diagnosis encounter)	
• ICD-10-CM injury codes[†] in this document • SELECT number of diagnoses per encounter (e.g., just primary diagnosis (Dx1)) • EXCLUDE codes ending in 7th digit D -S (to include initial encounter codes ending 7th digit A-C/ codes without 7th digits) • APPLY incident rule timeframe (e.g., 60 days) to selected digits (e.g., up to 5 digits)	• Follow up visits for ICD-10-CM injury codes listed in this document (i.e., ending D-R)[†] *For example* – for stress fracture codes M84.311, .112, .119 the 7th digit for long term effects includes: G = delayed healing K = non-union P = malunion As well as: • Sequelae for ICD-10-CM injury codes listed in this document (identified with 7th digit "S") [†] • May need to include procedural codes for costs or additional follow up visits for rehabilitation/physical therapy (e.g., Z51.89, encounter for other specified aftercare (e.g., physical therapy visit)	Post-traumatic Osteoarthritis	M16.4, .5 (hip) M17.2, .3 (knee) M18.2, .3 (carpometacarpal) M19.1 (shoulder) M19.9 (unspecified location)
		Acquired deforming conditions (finger/toes) *presumed to result from injury):*	M21.4 flat foot acquired
		Recurrent dislocation/subluxation	M22.0* Recurrent dislocation of patella M22.1* Recurrent subluxation of patella M24.4* Recurrent dislocation (unspecified, shoulder, elbow, wrist, hand, finger, hip, etc.)
		Cystic meniscus	M23.0* Cystic meniscus
		Derangement of meniscus (knee) due to old tear or injury	M23.2*
		Chronic instability of the knee	M23.5*
		Loose body	M23.4* (unspecified location, knee, shoulder, elbow, wrist, finger, hip, ankle, toe, other)
		Other articular cartilage disorders	M24.1* M24.50 (unspecified joint)
		Contracture	M24.5* (unspecified, shoulder, elbow, etc.)
		Ankylosis	M24.6* (unspecified joint, shoulder, wrist, etc.)
		Flail joint	M25.2* (unspecified location, shoulder, etc.)
		Other instability (joint)	M25.3*
		Joint stiffness	M25.6* (unspecified location, shoulder, etc.)
		Osteophyte	M25.7* (shoulder, hand, foot, etc.)
		Spondylolysis	M43.0*
		Spondylolisthesis	M43.1*
		Fusion of the spine	M43.2* (cervical, thoracic, lumbar, sacral)
		Sacroiliitis	M46.1 Sacroiliitis, not otherwise specified
		Other spondylosis with myelopathy/radiculopathy	M47.1* M47.2*
		Spondylosis without myelopathy or radiculopathy	M47.8* except below
		Other spondylosis	M47.89*, M47.9 (unspecified spondylosis)

STEP 1 Identify New Onset Injuries[a]	STEP 2 Follow-up & Sequela	STEP 3 Identify Additional MSK Injury-related Long-term Effects[b] (for initial diagnosis encounter)	
		Spinal stenosis	M48.0*
		Disc degeneration	M50.3* Other cervical disc degeneration M51.3* Other intervertebral disc degeneration
		Spinal instabilities	M53.2*
		Myositis ossificans traumatica	M61.0* (unspecified, shoulder, arm, hand, etc.)
		Calcification, ossification associated with burns	M61.3* (unspecified, arm, hand, thigh, leg, foot, other, multiple sites)
		Contracture of the muscle	M62.4*
		Muscle wasting and atrophy	M62.5 *
		Muscle weakness (generalized)	M62.81
		Calcific tendinitis	M65.2 (arm, hand, thigh, leg, foot, other, unspecified, multiple sites)
		Adhesive capsulitis of shoulder	M75.0*
		Pneumatic hammer syndrome	M75.21X
		Periarthritis, wrist	M77.2*
		Osteonecrosis due to previous trauma	M87.2* (various bones, hand, finger, toes, foot, ankle, multiple or unspecified sites)
		Osteolysis	M89.5* (unspecified, shoulder, arm, hand, thigh, leg, foot, ankle, other, multiple sites)
		Subluxation complex (vertebral)	M99.1*
		Intervertebral disc stenosis	M99.5*

Notes:
* Symbol used as the placeholder for additional ICD-10-CM digits (extension codes)
† Billable codes only
[a] Some new onset MSK injuries defined in this document may also have long-term effects (latent, recurrent, or chronic).
[b] The listed long-term effects are the primary long-term or chronic MSK conditions to include as part of overall burden of injuries. Not included are the potential long-term codes attributed to non-MSK systems. Additionally, procedural codes may need to be considered to reflect the full burden.

9 DISCUSSION OF NEXT STEPS

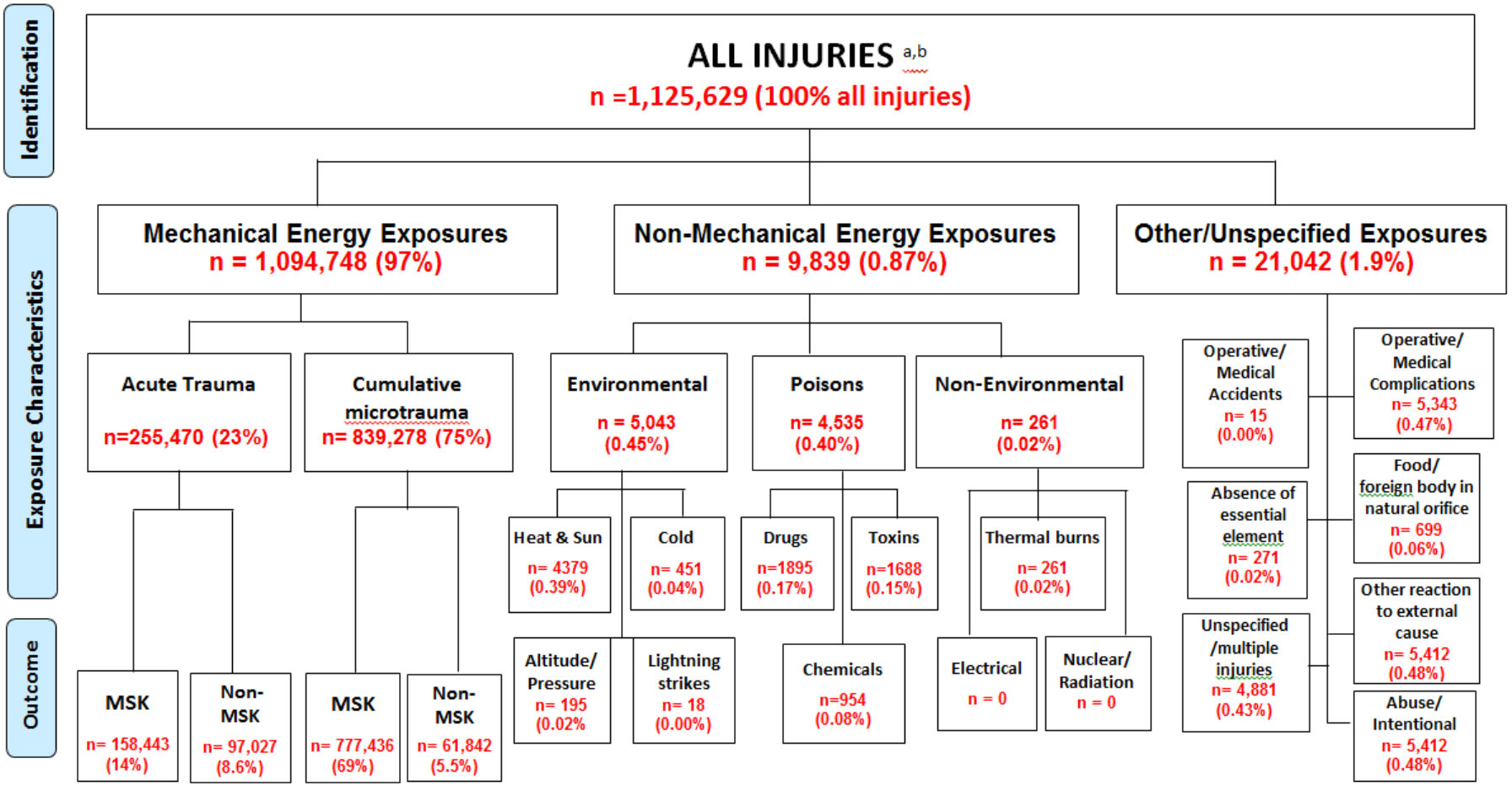
9.1 Applying the Taxonomy

The taxonomy provides a platform from which to better prioritize injury prevention strategies. Its application can highlight the types of injuries that represent the largest problem in a population. To demonstrate this, calendar year 2016 (CY16) medical encounter data for all U.S. Army Active Duty Soldiers (including Reserve, National Guard) for inpatient and outpatient visits (including purchased care) was obtained from the AFHSB to ascertain the estimated number and frequency of injury incidents in each category. Incident injury data was collected for first diagnosis only, initial encounters only (excluding D-R encounters), using a 60-day rule applied up to the 6th digit when available (some diagnoses have only the minimum of 4 digits). The 60-day rule to define new incidents was applied as the "gap" period following the last use of a specific diagnosis code.

The results (Figure 6 and Table 7) are empirical evidence that injuries caused by mechanical energy transfer far outnumber injuries from any other cause (97%). Of these, the majority are to the MSK system (83%), and most of those (69%) are the result of cumulative micro-traumas. The cumulative microtraumatic injuries are most often associated with overuse during physical training and/or assigned occupational tasks.

In addition to quantifying incident injuries, data were collected for incident encounters (primary diagnosis only) for the long-term MSK conditions (e.g., loose body, recurrent dislocation/subluxations, and meniscus derangement) and described in Table 6 (results shown in Table 8). These diagnoses are not considered injuries but are long-term MSK effects that are plausibly related to a prior MSK injury. For these incidents, codes with a 7th digit extension of D-S (the subsequent and sequelae medical visits for initial injury incidents) were included along with the additional MSK long-term effects codes listed in Table 6. A similar incident rule was applied.

These results validate past scientific literature that has described the substantial impact of MSK injuries and MSK injury-related long-term effects among Active Duty military populations (Jones et al., 2015; Marshall et al., 2014; Molloy et al., 2012; Hauret et al., 2010; IOM 1998). The past use of inconsistent injury definitions may have contributed to confusion about the magnitude of the problem. Injury prevention campaigns should prioritize MSK injuries and attempt to reduce their incidence by focusing on mitigation of the modifiable risk factors and causal stresses.



[a] *Source: Defense Medical Surveillance System (DMSS) as of 09-MAY-2017; Prepared by Armed Forces Health Surveillance Branch (AFHSB)*

[b] *Data included calendar year 2016 medical encounter data for all U.S. Army Active Duty Soldiers (including Reserve, National Guard) for inpatient and outpatient visits (including purchased care). Data collected for first diagnosis only, initial encounters only (i.e., excluding D-R encounters), using a 60-day rule applied up to the 6th digit when available (some diagnoses have just the minimum of 4 digits). The 60 day rule was applied as the "gap" period following the last use of a specific code.*

Figure 6. Injury Taxonomy Results: Injury Incidents, Active Duty Army, CY16[a, b]

Table 7. Injury Incidents by Taxonomy Categories, Active Duty Army, CY16

Exposure/ Energy Category	Injury /Energy SubCategory	Body System	Total # Injuries	% Total Injury	Gender		Age				Rank					
					Male	Female	<25	25-34	35-44	≥45	E1-E4	E5-E9	O1-O3	O4-O7	W01-W05	UNKNOWN
Mechanical	Acute		255,470	22.70	211,823	43,647	87,553	95,198	50,454	22,265	117,037	99,692	18,812	12,586	6,154	1,189
		Non-MSK	97,027	8.62	80,323	16,704	35,869	35,654	17,725	7,779	46,220	36,790	6,985	4,226	2,238	568
		MSK	158,443	14.08	131,500	26,943	51,684	59,544	32,729	14,486	70,817	62,902	11,827	8,360	3,916	621
	Cumulative		839,278	74.56	661,187	178,091	226,296	281,912	221,626	109,444	326,890	363,721	58,162	58,853	29,166	2,486
		Non-MSK	61,842	5.49	50,489	11,353	9,709	17,367	20,823	13,943	14,904	32,916	4,096	6,616	3,034	276
		MSK	777,436	69.07	610,698	166,738	216,587	264,545	200,803	95,501	311,986	330,805	54,066	52,237	26,132	2,210
	All MSK		935,879	83.14	742,198	193,681	268,271	324,089	233,532	109,987	382,803	393,707	65,893	60,597	30,048	2,831
	NeuroMSK(MSK +select neuro)		943,201	83.79	748,020	195,181	269,193	326,324	236,229	111,455	384,393	397,782	66,436	61,309	30,431	2,850
	All MECHNICAL		1,094,748	97.26	873,010	221,738	313,849	377,110	272,080	131,709	443,927	463,413	76,974	71,439	35,320	3,675
Environ-mental	Heat/Sun		4,379	0.39	3,344	1,035	2,934	1,071	265	109	3,349	703	239	54	28	6
	Altitude/Pressure		195	0.02	172	23	43	81	45	26	55	76	28	25	10	1
	Cold		451	0.04	352	99	273	137	33	8	305	99	34	5	7	1
	Electrical		18	0.00	16	2	8	5	5	0	12	6	0	0	0	0
	All ENVIRONMENTAL		5,043	0.45	3,884	1,159	3,258	1,294	348	143	3,721	884	301	84	45	8
Poisons	Drugs		1,895	0.17	1,323	572	983	613	216	83	1,243	528	50	24	19	31
	Chemicals		954	0.08	746	208	408	347	138	61	543	304	51	13	34	9
	Toxins		1,688	0.15	1,343	345	565	668	302	153	722	685	146	79	46	10
	All POISONS		4,535	0.40	3,410	1,125	1,956	1,627	656	296	2,508	1,515	247	116	99	50
Non-Environ-mental	Nuclear/Radiation		0	0.00	0	0	0	0	0	0	0	0	0	0	0	0
	Thermal (burns)		261	0.02	218	43	111	86	41	23	129	101	22	7	2	0
	Electrical		0	0.00	0	0	0	0	0	0	0	0	0	0	0	0
	All NON-ENVIRONMENTAL		261	0.02	218	43	111	86	41	23	129	101	22	7	2	0
Other	Operative/Medical Accidents		15	0.00	12	3	4	5	6	0	5	9	1	0	0	0
	Operative/Medical Complictns		5,343	0.47	4,070	1,273	1,037	1,820	1,566	920	1,535	2,734	428	447	168	31
	Unspecified/Multiple Injuries		4,881	0.43	3,947	934	1,718	1,859	877	427	2,243	1,876	367	257	99	39
	Absence of essential element(s)		271	0.02	184	87	179	59	22	11	201	44	18	5	2	1
	Abuse /Intentional		5,412	0.48	3,782	1,630	2,425	2,162	697	128	3,248	1,918	117	52	74	3
	Other foreign body/food		699	0.06	562	137	156	268	172	103	246	311	64	60	12	6
	Other Rxn to external cause		4,411	0.39	2,969	1,442	1,542	1,648	817	404	1,984	1,689	347	262	97	32
	All OTHER		21,042	0.02	15,532	5,510	7,064	7,824	4,160	1,994	9,466	8,586	1,342	1,084	452	112
ALL INJURY			1,125,629	1.00	896,054	229,575	326,238	387,941	277,285	134,165	459,751	474,499	78,886	72,730	35,918	3,845

Source: Defense Medical Surveillance System (DMSS) as of 09-MAY-2017; Prepared by Armed Forces Health Surveillance Branch (AFHSB)

Table 8. Injury-Related Musculoskeletal Long-term Effects, Active Duty Army, CY16

Long-Term MSK Condition /Body System Affected	Total # LT effect	% of Total	Gender		Age				Rank					
			Gender	Female	<25	25-34	35-44	≥45	E1-E4	E5-E9	O1-O3	O4-O7	W01-W05	UNKNOWN
Adhesive capsulitis	819	0.82	589	230	38	164	311	306	110	438	67	159	41	4
Ankylosis	227	0.23	179	48	30	71	73	53	55	120	17	23	11	1
Articular cartilage disorders	2,004	2.00	1,699	305	358	781	610	255	574	993	208	148	79	2
Calcific tendinitis	166	0.17	136	30	18	56	57	35	34	95	13	21	2	1
Chronic instability of knee	1,522	1.52	1,318	204	369	684	342	127	564	704	122	83	45	4
Contracture	880	0.88	721	159	154	309	262	155	258	432	71	82	31	6
Cystic meniscus	120	0.12	106	14	15	42	41	22	36	61	10	11	2	0
Disc degeneration	16,008	16.01	13,798	2,210	1,059	4,812	6,568	3,569	2,470	9,905	1,013	1,590	946	84
Derangement, meniscus	3,187	3.19	2,804	383	348	917	1,131	791	656	1,713	268	405	133	12
Flail joint	46	0.05	36	10	3	18	20	5	11	27	4	3	1	0
Flat foot (acquired)	6,748	6.75	5,219	1,529	1,673	2,324	1,930	821	2,538	3,016	484	492	213	5
Fusion of the spine	463	0.46	402	61	27	98	198	140	54	308	22	49	28	2
Intervertebral disc stenosis	98	0.10	74	24	5	19	46	28	11	53	8	20	6	0
Joint stiffness	3,757	3.76	3,156	601	773	1,349	1,049	586	1,180	1,801	330	326	114	6
Loose body	498	0.50	441	57	94	194	149	61	142	252	53	34	14	3
Muscle calcification/ossification	1	0.00	1	0	0	0	0	1	0	1	0	0	0	0
Muscle constracture	305	0.30	222	83	62	126	77	40	89	165	27	19	4	1
Muscle wasting and atrophy	368	0.37	304	64	52	124	131	61	101	178	39	35	13	2
Muscle weakness	4,619	4.62	3,359	1,260	1,547	1,406	1,050	616	2,094	1,678	318	382	134	13
Myositis ossificans traumatica	20	0.02	17	3	4	6	9	1	5	15	0	0	0	0
Osteoarthritis (post-traumatic)	1,613	1.61	1,438	175	97	436	663	417	240	944	133	196	88	12
Osteolysis	127	0.13	119	8	21	74	27	5	35	65	15	7	5	0
Osteonecrosis due to previous trauma	17	0.02	16	1	1	8	6	2	2	13	2	0	0	0
Osteophyte	695	0.69	593	102	63	210	285	137	127	402	51	63	51	1
Other instability	6,007	6.01	5,009	998	1,668	2,519	1,405	415	2,396	2,569	557	317	160	8
Other spondylosis	2,201	2.20	1,841	360	36	375	958	832	180	1,359	141	336	166	19
Periarthritis	7	0.01	5	2	1	1	1	4	1	4	0	2	0	0
Pneumatic hammer syndrome	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Recurrent Dislocation/Subluxation	1,598	1.60	1,369	229	640	643	265	50	796	587	118	55	31	11
Sacroiliitis, not elsewhere classified	4,565	4.56	2,919	1,646	766	1,609	1,455	735	1,317	2,281	349	397	210	11
Sequela (various – fractures, etc)	6,302	6.30	5,194	1,108	1,757	2,613	1,379	553	2,630	2,681	497	308	179	7
Spinal instabilities	316	0.32	229	87	43	100	105	68	82	164	24	32	13	1
Spinal stenosis	4,839	4.84	4,177	662	190	1,121	1,897	1,631	581	3,060	307	564	281	46
Spondylolisthesis	1,980	1.98	1,695	285	220	606	705	449	386	1,141	138	214	88	13
Spondylosis w/o myelopathy or radiculopathy	10,070	10.07	8,403	1,667	565	2,773	4,096	2,636	1,390	6,565	643	909	504	59
Spondylosis, other	7,927	7.93	6,617	1,310	474	2,140	3,288	2,025	1,149	4,809	530	931	479	29
Spondylosis, other with radiculopathy	2,100	2.10	1,841	259	104	593	866	537	285	1,308	130	234	129	14
Spondylolysis	1,338	1.34	1,136	202	195	436	433	274	313	749	77	137	59	3
Subluxation complex	208	0.21	160	48	43	93	61	11	73	99	10	13	10	3
Subsequent (various – fractures, etc)	6,242	6.24	3,237	3,005	4,470	1,508	205	59	5,679	367	135	44	17	0
All MSK Long Term Effects assumed related to prior injury	**100,008**	100.00	80,579	19,429	17,983	31,358	32,154	18,513	28,644	51,122	6,931	8,641	4,287	383

Source: Defense Medical Surveillance System (DMSS) , 09-MAY-2017, addendum 22-May-2017; Prepared by Armed Forces Health Surveillance Branch (AFHSB)

9.2 Improve Consistency in Future Monitoring, Investigating, and Reporting

9.2.1 Use This Document as a Foundation Reference

The use of inconsistent injury definitions and diagnosis codes poses obstacles to interpreting injury trends, determining risk factors, evaluating the effectiveness of interventions, and establishing public health priorities. The taxonomy and definition of "injury" described in this document provide the foundation for a standardized, all-inclusive categorization of physical injuries for use in public health and injury-related studies. Investigators should use this document as a foundation reference to generate a case definition of "injury" applicable to the scope of their study.

For example, future Army "all injury" annual surveillance and monitoring reports can standardize the operational definition of injuries with the specific categories, codes and other operational considerations provided herein. As another example, the subset of injury diagnoses for low back and lower extremity MSK injuries highlighted in the monthly training-related injury reports (TRIR) for IET/AIT training sites can be re-evaluated against the categories of injuries defined in this document.

9.2.2 Document Changes or Alternative Approaches

When unique studies require alternative approaches to the definitions, categories, codes, and/or recommended operational considerations in this document, the modification should be documented clearly and transparently. It is also anticipated that certain details contained in this document will be re-evaluated over time and that some changes may be warranted. When necessary, these changes or alternatives will be captured as addendums to this document.

9.3 Adequately Document Methodology in Studies and Surveillance Reports

The following subparagraphs include specific methodological considerations that should be documented for each injury-related report or study.

9.3.1 Purpose

A study's purpose should clearly explain whether only initial onset injuries are identified or whether both new onset as well as associated long-term effects (e.g., recurring and chronic MSK conditions) are captured to show the overall medical burden.

9.3.2 Case Definitions and Clarification of Exclusions and Inclusions

The purpose of a study should refer to the injury definition(s), categories, and codes or specific subset of categories and codes as presented in this document. The case definition for "injury" should also specify the application of operational rules such as incident rules (e.g., 60 days) and selection diagnosis (i.e., only the "primary" diagnosis per encounter, or "all" diagnoses documented per encounter). The description and justification for the case definition should address—

- The intent of injuries included (unintentional, intentional);
- Severity (fatal and/or non-fatal injury; hospitalized (inpatient) and/or ambulatory (outpatient)) and any additional metrics (see below);
- Types of exposures based on energy transferred (mechanical energy, non-mechanical energy, or other);
- Acute traumatic and/or cumulative microtraumatic injuries from mechanical energy transfers; and
- Body system(s) included (e.g., MSK, neurological).

9.3.3 Reporting Metrics for Injury Incidence

Investigators should document the methodology and metrics used to identify injuries and calculate injury incidence and rates. Examples include the following:

- Some analyses use the total number of *all medical encounters* for the included injury diagnosis codes to describe the overall burden of injuries on the health care system `within a specified timeframe. This can include initial injury visits, as well as follow-up visits, visits for the sequelae of the injury (such as "subsequent" encounter and codes ending in D-R), or other long-term effects of injuries (see below).

- The Army/installation injury reports, such as those from the SMS and PH360, report injury rates as the number of new onset injuries per 1,000 person-years of exposure among non-deployed Soldiers. This information is based on the primary, first-listed diagnosis from inpatient and outpatient encounters. If a 7th digit in an ICD-10-CM code indicates a follow-up visit (e.g., D-R), that data point is not included as an initial (index) injury. The reports apply a 60-day rule to identify new onset injuries. There are two approaches with which one can apply this rule: "simplistic incidence" and "60-day gap." When the simplistic incidence rule is applied, subsequent encounters with the same ICD-10-CM diagnosis code within 60 days of the first encounter are considered follow-up visits for the same injury. When the "60-day gap rule" is applied, a documented injury continues to be identified as the same injury until there is at least a 60-day gap before that code is recorded again. Use of the "gap rule" has increased, but since different studies may apply different rules, the approach of a particular study should be clarified in its methods. The 60-day rule was originally adopted from a 2002 DOD surveillance case definition (DOD, 2002) that was accepted after the effects of using varying time cut-points (30, 60, 90 days) to identify new onset injuries were examined. The working group reviewed ambulatory encounter data for non-deployed Soldiers and found no substantial differences in the number of new onset injuries when a 30-, 60-, or 90-day rule was applied. Current use of the 60-day rule is therefore not based on scientific evidence but is a matter of consistency. Given all of the changes represented by the new ICD-10-CM codes, substantiation of the 60-day rule may be warranted.

- A different operational definition of injury has been used to monitor injuries that occur during BCT, One Station Unit Training (OSUT), and AIT. Injury rates are calculated as the number of trainees with one or more injuries per 100 person-months of training. This definition allows for the comparison of injury incidence among trainees in courses of varying lengths. Injury incidence is reported as the number and percentage of trainees who suffered one or more injuries during their particular course. Course lengths in IET vary from 10 weeks (70 days) for BCT to 13–19 weeks (91–171 days) for OSUT, depending on military occupational specialty; and are of variable duration in AIT as well.

9.3.4 Reporting Metrics for Injury Severity

When reporting results from injury surveillance or studies, the injury case definition should ideally specify not only which types of injury are included but also the degree of severity of injuries. For example, some studies may focus only on fatal injuries that are reported in mortality registers and Army safety data. Most surveillance reports rely on ICD-10-CM diagnosis codes from medical encounter data in electronic health records. The standard severity definition applied to population injury rates reported from this encounter data has therefore been *any injury that required at least one medical encounter* (with the implication that injuries resulting in pain and/or limited physical activity for which individuals did not seek medical care are of lesser severity). Alternatively, targeted studies using encounter data may include only injuries of a specific type that have an assumed level of notable severity or costs, such as amputations, spinal cord injuries, traumatic fractures, or stress fractures (Ruscio, 2010).

Future studies may identify additional means to expand on the use of ICD-10-CM data from electronic health records to further differentiate levels of severity. For example, injuries documented in medical records with an initial encounter may also be denoted by subsequent encounter end codes (e.g., D-R). Subsequent visits may be considered a measure of additional health burden or severity of the initial injury incident. Additional information (such as cost of care, medical profile data, or self-report survey data) may help refine what is known regarding injury severity. Additional assessment of the types of survey questions used to characterize the severity of injuries (Timpka et al., 2015; Palmer-Green et al., 2013) should be performed to establish standardized metrics. Examples of approaches include—

- Type of medical care (e.g., none, ER or non-ER, outpatient or inpatient, single visit, more than one visit).

- Amount of physical impairment and/or duration of restricted activity and or pain (e.g., per Timpka et al., 2015; and Appendix E).

- Injuries of a specific severity/type (e.g., amputation, traumatic brain injury, fracture, stress fracture).

9.3.5 Long-term Effects and Conditions

As previously described, new onset or index injuries may have latent effects or subsequently be exacerbated, become a recurrent injury, or evolve into an intermittent, long-term, or chronic

condition. The term "subsequent injury" has been proposed to encompass all of these long-term effects and conditions (Finch and Cook, 2014). Studies designed to calculate incidence of new injuries will typically not include these diagnoses (e.g., will include only initial medical visits or visits within a specified timeframe such as 60 days). Long-term or subsequent effects and medical encounters, however, should be included in overall burden of injuries reporting. For example, a degenerative joint disease of the knee may occur in an individual years after his or her having sustained an acute traumatic or cumulative microtraumatic injury to the knee. Because prior evidence has demonstrated that long-term MSK effects pose the most significant public health burden to military and civilian populations (Marshall, 2014), the MSK long-term effects noted in Table 6 should be considered. To reflect the full burden of injury, additional long-term conditions (e.g., neurological conditions attributed to environmental injuries or poisonings) and/or procedures may also need to be considered.

9.3.6 External Causes

With the exception of ICD-10-CM T-codes (which describe diagnosis and mechanism and/or intent of injury), the specific conditions, circumstances, or activity causing an injury cannot be determined by most diagnostic codes. Using external cause codes (Chapter 20, V00-Y99) can provide a better understanding of the nature and mechanism (cause) of the injury. The ICD-10-CM external cause codes can be used with any injury diagnosis code (reference ICD-10-CM Official Guidelines for Coding and Reporting). There is no mandatory reporting requirement in the military health system or the civilian sector for providers and coders to use cause codes. Many medical providers see no benefit to using these codes (which do not support additional billing) and therefore are not motivated to do so. As a result, these external cause codes are seldom used. Investigators choosing to include V00-Y99 codes in analyses may modify the grouping of certain injuries if justified by external causes. Additional evaluation of the external causes codes used with the various injury codes in this document is recommended.

9.3.7 Limitations

The limitations associated with the taxonomy (described in Section 8 of this document) address an important reporting element in any epidemiological study of injuries. Injury studies should document the methodology and assumptions up front but should also summarize the impact of the major limitations in the discussion or conclusions.

10 CONCLUSIONS AND RECOMMENDATIONS

The definitions, taxonomy, and specific medical codes provided in this public health information paper fill a scientific gap. This document helps align public health, research, and patient care communities to identify and monitor injuries more consistently. To improve the quality of future injury surveillance and investigative studies, the operational next steps described in paragraph 9 of this document are recommended. ICD-10-CM code categories are summarized in Appendix E and are available from the APHC-IPD as a complete list of ICD-10-CM codes in a searchable Microsoft Excel® spreadsheet.

The IPD will use this document as a foundation for the methodology of its future injury epidemiology efforts. The taxonomy is also recommended to other military and non-military epidemiological and research organizations to support injury prevention efforts.

11 POINT OF CONTACT

The APHC Injury Prevention Division is the point of contact for this project and can be reached via e-mail at usarmy.apg.medcom-aphc.mbx.injuryprevention@mail.mil; or by phone at 410-436-4655 (commercial) or 584-4655 (DSN). Specific questions may be directed to the authors listed on the cover page of this document.

Approved:

BRUCE H. JONES, MD, MPH
Chief
Injury Prevention Division

APPENDIX A

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APPENDIX B

Description of Selected ICD-10-CM Diagnostic Code Series

The tables in this appendix describe subchapter series of ICD codes that are relevant to injury studies. The codes include hyperlinks to online ICD information.

Table B–1. ICD-10-CM S-Codes, Chapter 19, Injury, Poisoning and Certain Other Consequences of External Causes

ICD-10 Injury S-Code Series [a, b, c]	Nature of Injury (each region)
S00-S09 Injuries to the head *(includes ear, eye, teeth., face)*	.0 Superficial injury
S10-S19 Injuries to the neck	.1 Open wound
S20-S29 Injuries to the thorax	.2 Fracture
S30-S39 Injuries to the abdomen, lower back, lumbar spine, pelvis, external genitals	.3 Dislocation/sprain
S40-S49 Injuries to the shoulder and upper arm	.4 Nerves/spinal cord
S50-S59 Injuries to the elbow and forearm	.5 Blood vessels
S60-S69 Injuries to the wrist, hand and fingers	.6 Muscle/fascia/tendon
S70-S79 Injuries to the hip and thigh	.7 Crushing
S80-S89 Injuries to the knee and lower leg	.8 Other
S90-S99 Injuries to the ankle and foot	

[a] Excludes damage from thermal burns / corrosions (T20-32), effects from foreign bodies (T14-17), frost bite (T33-34).
[b] Includes extension codes for specific injury type, body component/ side of body, and initial (A), follow-up (D-R) or sequelae.
[c] Use of these S-codes requires use of a secondary code(s) from Chapter 20, “External causes”

Table B–2. ICD-10-CM T-Codes, Chapter 19, Injury, Poisoning and Certain Other Consequences of External Causes

ICD Injury T-Code Series[a, b]
T07-T07 Injuries involving multiple body regions
T14-T14 Injury of unspecified body region
T15-T19 Effects of foreign body entering through natural orifice
T20-T25 Burns and corrosions of external body surface, specified by site
T26-T28 Burns and corrosions confined to eye and internal organs
T30-T32 Burns and corrosions of multiple and unspecified body regions
T33-T34 Frostbite
T36-T50 Poisoning by, adverse effect of and under-dosing of drugs, medicaments and biological substances
T51-T65 Toxic effects of substances chiefly non-medicinal as to source
T66-T78 Other and unspecified effects of external causes
T79-T79 Certain early complications of trauma
T80-T88 Complications of surgical and medical care, not elsewhere classified

Notes:
[a] Excludes sunburn (L) and non-thermal or chemical blisters (S-codes)
[b] Use of these T-codes does not require a Chapter 20 external cause code.

Table B–3. ICD-10-CM M-Codes, Chapter 13, Diseases of the MSK System and Connective Tissue

ICD-10 M-Codes[a, b]
M00-M02 Infectious arthropathies
M05-M14 Inflammatory polyarthropathies
M15-M19 Osteoarthritis
M20-M25 Other joint disorders[b]
M26-M27 Dentofacial anomalies [including malocclusion] and other disorders of jaw
M30-M36 Systemic connective tissue disorders
M40-M43 Deforming dorsopathies
M45-M49 Spondylopathies
M50-M54 Other dorsopathies[b]
M60-M63 Disorders of muscles
M65-M67 Disorders of synovium and tendon
M70-M79 Other soft tissue disorders[b]
M80-M85 Disorders of bone density and structure
M86-M90 Other osteopathies
M91-M94 Chondropathies
M95-M95 Other disorders of the musculoskeletal system and connective tissue
M96-M96 Intraoperative and postprocedural complications and disorders of MSK system, NEC
M99-M99 Biomechanical lesions, NEC

Notes:
NEC = not elsewhere classified
[a] Not all M-codes are considered to be "injuries."
[b] Though selected subcodes in this category are considered overuse injuries, additional codes may need to be included.

APPENDIX C

Injury Definitions Found in the Literature

This appendix provides primary examples of the injury definitions and references the APHC-IPD reviewed prior to the development of the taxonomy.

Table C-1. Examples of Injury Definitions Reviewed

Source	Definition
National Committee for Injury Prevention and Control, 1989	"…any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen."
Institute of Medicine (IOM), Reducing the Burden of Injury, 1999	"all injury events are attributable to the uncontrolled release of one of five forms of physical energy (kinetic, chemical, thermal, electrical, and radiation). Interventions can be made during three temporal phases in relation to the injury event: (1) a pre-event phase, during which the energy becomes uncontrolled; (2) a brief event phase in which the uncontrolled energy is transferred to the individual, resulting in injury if the energy transfer exceeds the tolerance of the body to absorb it; and (3) a post-event phase, during which attempts can be made to restore homeostasis and repair the damage."
DoD Military Injury Metrics Working Group, 2002	A traumatic* wound or other condition of the body by external force or deprivation (drowning, suffocation, exposure, cold injury, dehydration), including stress or strain. A non-traumatic* physiological harm or loss of capacity produced by systemic; continued or repeated stress or strain; exposure to toxins, poison, fumes, etc., or other continued and repeated exposures to conditions of the environment over a long period of time. To include the following qualifiers: - Injuries are nonfatal traumatic wounds or other conditions of the body caused by external force or exposure (i.e., heat or cold injury) or non-traumatic physiological harm or loss of capacity caused by continued or repeated neuro-MSK stress or strain. - Injuries may occur in garrison, field, or deployed environments; on or off-duty; and may or may not result in lost work time (hospitalizations, quarters, convalescent leave) or limited duty prescriptions. - Injuries do not include any conditions occurring as a result of hostile fire, the direct action of an enemy, or hostile force or criminal acts where intent is known. -Injury cases are identified by specific ICD codes determined and defined by Working Group * Definitions of both "injury" and "illness" from DoD Instruction 6055.7 were necessary to include traumatic cases identifiable as to time, place, and specific event or incident and cumulative trauma cases (e.g., stress fractures, tendonitis, carpal tunnel syndrome) that occur as a result of continued and repeated exposure to physiologic or biomechanical stresses in military injury metrics.
Medical Dictionary (2003) (accessed online 2016)	injury [in´jŭ-re] harm or hurt; usually applied to damage inflicted on the body by an external force Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health, Seventh Edition©, 2003, by Saunders, an imprint of Elsevier, Inc. Accessed 30 June 2016 via the Free Dictionary- Medical Dictionary at http://medical-dictionary.thefreedictionary.com/injury
World Health Organization (WHO), 2015	Bodily harm affecting one or more systems (i.e., MSK, nervous, integumentary, circulatory, etc.) caused by mechanical overload of related structures. Potential overload results from either high intensity forces or the cumulative effect of low intensity forces (*www.who.int/occupational_health/.../oehmsd3.pdf*)
CDC, 2005 (Injury Surveillance Training Manual)	Injury: exposure to physical agents such as mechanical energy, heat, electricity, chemicals, and ionizing radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance http://www.cdc.gov/injury/pdfs/Participant_Guide.pdf
CDC, 2007 (WISQARS)	Nonfatal injury: bodily harm resulting from severe exposure to an external force or substance (mechanical, thermal, electrical, chemical, or radiant) or a submersion without intent to cause injury http://www.cdc.gov/ncipc/wisqars/nonfatal/definitions.htm

PHIP No. 12-01-0717, A Taxonomy of Injuries for Public Health Monitoring and Reporting

Source	Definition
Army Regulation 385-10, Army Safety Program, 2007/rev June 2010	A traumatic wound or other condition of the body caused by external force, including stress or strain. The injury is identifiable as to time and place of occurrence and member or function of the body affected and is caused by a specific event, incident, or series of events or incidents within a single day or work shift.
NIOSH, 2014 (Traumatic Injury Program description) (Also IOM, 2009)	Traumatic occupational injury is defined as any damage inflicted to the body by energy transfer during work with a short duration between exposure and the health event [are addressed by the NIOSH Traumatic Injury program]…. Injuries associated with repetitive or cumulative trauma [are addressed by the NIOSH MSK Disorders Program.]
Finch and Cook, 2014	"Acute injury can be defined as [any physical complaint...] caused by the inability of the body's tissues to maintain its structural or functional integrity following an instantaneous transfer or energy to the body (e.g. from impact or sudden movement)." "injuries caused by an accumulated energy transfer, rather than a clearly identifiable single event, are often called overuse injuries."
Timpka et al., 2015 consensus paper for track and field injury research	"A physical complaint or observable damage to body tissue produced by the transfer of energy experienced or sustained by an athlete during participation in Athletics training or competition, regardless of whether it received medical attention or its consequences with respect to impairments in connection with competition or training." (*Also defines onset, severity, event, and others*)
*DoD Dictionary of Military and Associated Terms JP 1-01; 02/2016**	1. A term comprising such conditions as fractures, wounds, sprains, strains, dislocations, concussions, and compressions. 2. Conditions resulting from extremes of temperature or prolonged exposure. 3. Acute poisonings (except those due to contaminated food) resulting from exposure to a toxic or poisonous substance. *Also cited in DoDI 6055.07, 2011
USACRC/Safety Center, 2016 (e.g., Army Accident Statistics June 2016)	Nonfatal injuries include: permanent total disability; permanent partial disability; days away from work or training beyond the day or shift on which it occurred or disability at any time; or a nonfatal injury or illness resulting in restricted work, transfer to another job, medical treatment greater than first aid, needle stick injuries, and cuts from sharps that are contaminated from another person's blood or other potentially infectious material; medical removal under medical surveillance requirements of an Occupational Safety and Health Administration (OSHA) standard; occupational hearing loss; or a work-related tuberculosis case.
BLS, Methods for Occupational Safety and Health, accessed June 2016	*Occupational injury* is any injury, such as a cut, fracture, sprain, amputation, and so forth that result from a work-related event or from a single instantaneous exposure in the work environment. *Occupational illness* is any abnormal condition or disorder caused by exposure to factors associated with employment, other than those resulting from an instantaneous event or exposure. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact. Five categories of occupational illnesses include: skin, respiratory, poisoning, hearing loss, and 'all other occupational illnesses' (includes heatstroke, heat stress, frostbite, decompression sickness, effects of nonionizing radiation, bloodborne pathogens, anthrax, hepatitis, AIDS/HIV, conditions due to repeated motion, vibration, or pressure such as carpal tunnel syndrome' synovitis, tenosynovitis, bursitis, Raynaud's).
U.S. Bureau of Labor Case Definitions 2016	See page C–6.

Table C-2. Description of Different Forms of Energy [a, b]

Forms of Energy	Description
Mechanical	Stored mechanical energy is the potential energy stored in objects by the application of a force. The *overall mechanical energy is the* sum of that potential energy and the kinetic energy *from the movement of an object (motion).* *Explanation/Example:* energy between a moving (kinetic) source (object or surface) and a non-moving source (object or surface) when they meet.
Thermal (Heat)	Thermal energy or heat energy reflects the temperature difference between two systems. *Explanation/Example:* the collective kinetic and potential energy of the moving and vibrating molecules. Temperature is a measure of how much thermal energy something has, i.e. the faster the molecules are moving around and/or vibrating, the more kinetic and potential energy the molecules have, and the higher the temperature.
Light/Radiant (Electromagnetic)	Radiant energy is the kinetic energy from electromagnetic waves, which includes visible/ultraviolet light, radio waves, x-rays, and gamma-rays, and microwaves. *Explanation/Example:* Light is kinetic electromagnetic energy from photons moving to different energy levels in atoms. Solar energy is an example. Sunlight contains "ultraviolet light", which consists of high energy photons that can cause physical damage to skin. Radio waves consist of low energy photons (long wavelength and high frequencies - in the infrared band and lower) that your eyes can't perceive.
Electrical	Electrical energy is the kinetic energy from the movement of electrons when they move from one atom to another. *Explanation/Example:* Lightning and electricity are examples
Chemical	Chemical energy is the stored (potential) energy in the bonds of atoms or molecules and is transferred as a result of the chemical reactions between those bonds. *Explanation/Example:* Chemical energy exists because of the electric and magnetic forces of attraction exerted between the different parts of each molecule—the same attractive forces involved in thermal vibrations. These parts get rearranged in chemical reactions, releasing or adding to this potential energy. Glucose (blood sugar) has "chemical energy" because the glucose releases energy in the body when chemically reacted (combusted) with oxygen. Muscles then use this energy to generate mechanical force and heat.
Nuclear or atomic	Nuclear energy is a form of electromagnetic energy resulting from reactions that involve changes in the structure of the nuclei of atoms. *Explanation/Example:* Nuclear fission, nuclear fusion, and nuclear or radioactive decay are examples.

[a] There can be several different forms of energy, depending on focus and categorization method; this document focuses on six primary energy forms. Other examples include sound (sonic) energy—kinetic energy (motion) from sound (compression) waves that travel through air or another medium—and gravitational energy—potential energy associated with attraction between two objects based on their mass.

[b] Sources:

Jones, Andrew Zimmerman. Energy - Definition and Examples: What Energy Means in Science. Updated July 29, 2016. Online article at: http://physics.about.com/od/glossary/g/energy.htm Accessed 1/23/2017

Helmnstine, A M. Name 5 Types of Energy: Main Forms of Energy and Examples Online article at: http://chemistry.about.com/od/thermodynamics/a/Name-5-Types-Of-Energy.htm Accessed 1/23/2017

U.S. Bureau of Labor—Occupational Safety and Health Definitions
Accessed at: http://www.bls.gov/iif/oshdef.htm (September 8, 2016)

An injury or illness is considered by the OSHA to be **work-related** if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing condition.

Recordable cases include work-related injuries and illnesses that result in—

- Death
- Loss of consciousness
- Days away from work
- Restricted work activity or job transfer
- Medical treatment (beyond first aid)
- Significant work related injuries or illnesses that are diagnosed by a physician or other licensed health care professional. These include any work-related case involving cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum.
- Additional criteria that can result in a recordable case include—
  - Any needle-stick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material.
  - Any case requiring an employee to be medically removed under the requirements of an OSHA health standard.
  - Tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed healthcare professional after exposure to a known case of active tuberculosis.
  - An employee's hearing test (audiogram) reveals: (1) that the employee has experienced a Standard Threshold Shift (STS) in hearing in one or both ears (averaged at 2000, 3000, and 4000 Hz) and (2) the employee's total hearing level is 25 decibels (dB) or more above the audiometric zero (also averaged at 2000, 3000, and 4000 hertz (Hz) in the same ear(s) as the STS.

Days away from work, days of restricted work activity or job transfer [DART] are cases that involve days away from work, or days of restricted work activity or job transfer, or both.

Cases involving days away from work are cases requiring at least one day away from work with or without days of job transfer or restriction.

Job transfer or restriction cases occur when, as a result of a work-related injury or illness, an employer or healthcare professional keeps, or recommends keeping an employee from doing the routine functions of his or her job or from working the full workday that the employee would have been scheduled to work before the injury or illness occurred.

Other recordable cases are recordable cases that do not involve death, days away from work or days of restricted work activity or job transfer.

Incidence rate is the number of injuries and/or illnesses per 100 full-time workers and were calculated as: (N/EH) X 200,000 where:

- N = number of injuries and/or illnesses
- EH = total hours worked by all employees during the calendar year
- 200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

Occupational injury is any wound or damage to the body resulting from an event in the work environment.

Occupational illnesses

Skin diseases or disorders are illnesses involving the worker's skin that are caused by work exposure to chemicals, plants or other substances. Examples: contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; friction blisters, chrome ulcers; inflammation of the skin.

Respiratory conditions are illnesses associated with breathing hazardous biological agents, chemicals, dust, gases, vapors, or fumes at work. Examples: silicosis, asbestosis, pneumonitis, pharyngitis, rhinitis or acute congestion; farmer's lung, beryllium disease, tuberculosis, occupational asthma, reactive airways dysfunction syndrome [RADS], chronic obstructive pulmonary disease [COPD], hypersensitivity pneumonitis, toxic inhalation injury, such as metal fume fever, chronic obstructive bronchitis and other pneumoconioses.

Poisoning includes disorders evidenced by abnormal concentrations of toxic substances in blood, other tissues, other bodily fluids, or the breath that are caused by the ingestion or absorption of toxic substances into the body. Examples: poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzene, benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays such as parathion or lead arsenate; poisoning by other chemicals such as formaldehyde.

Hearing loss noise-induced hearing loss for recordkeeping purposes is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more in either ear at 2000, 3000, and 4000 hertz (Hz) and the employee's total hearing level is 25 decibels (dB) or more above the audiometric zero (also averaged at 2000, 3000, and 4000 Hz) in the same ear(s).

All other occupational illnesses Examples: heatstroke, sunstroke, heat exhaustion, heat stress and other effects of environmental heat; freezing, frostbite, and other effects of exposure to low temperatures; decompression sickness; effects of ionizing radiation (isotopes, x-rays, radium); effects of nonionizing radiation (welding flash, ultra-violet rays, lasers); anthrax; bloodborne pathogenic diseases such as AIDS, HIV, hepatitis B or hepatitis C; brucellosis; malignant or benign tumors; histoplasmosis; coccidioidomycosis.

Case characteristics

Nature of injury or illness names the principal physical characteristic of a disabling condition, such as sprain/strain, cut/laceration, or carpal tunnel syndrome.

Part of body affected is directly linked to the nature of injury or illness cited, for example, back sprain, finger cut, or wrist and carpal tunnel syndrome.

Source and secondary source of injury or illness identify the objects, substances, equipment, and other factors that were responsible for the injury or illness incurred by the worker or that precipitated the event or exposure. Examples are a heavy box, a toxic substance, fire/flame, and bodily motion of injured/ill worker.

Event or exposure signifies the manner in which the injury or illness was produced or inflicted, for example, overexertion while lifting or fall from ladder.

Median days away from work is the measure used to summarize the varying lengths of absences from work among the cases with days away from work. Half the cases involved more days and half involved less days than a specified median.

> **(2011 and forward) Musculoskeletal disorders (MSDs)** include cases where the nature of the injury or illness is pinched nerve; herniated disc; meniscus tear; sprains, strains, tears; hernia (traumatic and non-traumatic); pain, swelling, and numbness; carpal or tarsal tunnel syndrome; Raynaud's syndrome or phenomenon; MSK system and connective tissue diseases and disorders, when the event or exposure leading to the injury or illness is overexertion and bodily reaction, unspecified; overexertion involving outside sources; repetitive motion involving microtasks; other and multiple exertions or bodily reactions; and rubbed, abraded, or jarred by vibration.
>
> **(2010 and prior) MSDs** include cases where the nature of the injury or illness is sprains, strains, tears; back pain, hurt back; soreness, pain, hurt, except the back; carpal tunnel syndrome; hernia; or MSK system and connective tissue diseases and disorders, when the event or exposure leading to the injury or illness is bodily reaction/bending, climbing, crawling, reaching, twisting; overexertion; or repetition. Cases of Raynaud's phenomenon, tarsal tunnel syndrome, and herniated spinal discs are not included. Although they may be considered MSDs, the survey classifies these injuries and illnesses in categories that also include non-MSD cases.

APPENDIX D

Comparison of Military Case Definitions and Injury Codes:

Differences between the Recommended Taxonomy and ICD-10-CM Code Categories and Armed Forces Health Surveillance Branch Case Definitions

This appendix summarizes differences between the ICD-10-CM codes in the AFHSB case definitions[1] and the codes selected for inclusion in this taxonomy, the latter of which is intended to provide criteria for defining all new-onset (incident) injuries. Most of the AFHSB case definitions were developed or updated in conjunction with various SMEs within the DOD, including APHC personnel, to support evaluations and the routine monitoring and reporting of unique types of military-relevant conditions. Some of the case definitions include associated codes for conditions or symptoms that may be relevant to an investigation of a specific diagnosis of interest but are not "injuries" as defined by this taxonomy. Because the development of this taxonomy included an in-depth review of the relatively new ICD-10, a few new codes are recommended for future consideration in defining cases for surveillance.

[1] AFHSB case definitions were last downloaded 28 February 2017 from https://www.health.mil/Military-Health-Topics/Health-Readiness/Armed-Forces-Health-Surveillance-Branch/Epidemiology-and-Analysis/Surveillance-Case-Definitions

Table D–1. Eye Injuries

AFHSB Case Definition (January 2016)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
S00.1 contusion of eyelid and periocular areaS01.10-.15 wounds to eyelid and periocular area S04.01A injury of optic nerve S04.1-.4 injury of eye-related nerve S02.2* other and unspecified superficial injuries of eyelid and periocular area S02.3 fracture of orbital floor S02.92 unspecified fracture of facial bones S05.* contusions/abrasions/laceration/ wounds/penetrations H18.21 corneal edema secondary to contact lens H21.0 hyphema/anterior segment H21.53 iridodialysis/anterior segment H26.10 unspecified traumatic cataract H26.11 localized traumatic opacities H26.13 total traumatic cataract) H31.30, .31, .32 (hemorrhage/rupture H33.0* retinal detachments and breaks H35.6 retinal hemorrhage H43.1 vitreous hemorrhage H44.00 unspecified purulent enophthalmitis T15* foreign body on external eye T26.1-.4 burn of eye/eye area T26.5-.9 corrosions of eye/eye area	The AFHSB eye injury case definition was originally developed in 1999 and since updated (2008, 2011, and 2016) by the AFHSB Tri-Service Vision Conservation and Readiness Program (TSVCRP) at the Army Public Health Center (APHC). The definition is used by AFHSB in an annual edition of the Medical Surveillance Monthly Report and a quarterly report for the TSVCRP. A primary goal of eye injury surveillance is to identify injuries that can be prevented, such as through the use of protective eyewear. The current case definition groups eye injuries into categories based on severity and region. While reviewing these codes for the Taxonomy, an APHC ophthalmologist noted that some diagnoses included in the AFHSB case definition are unlikely to always - or 'most often' - be an "injury" (i.e., caused by an external transfer of energy). In addition, a few diagnoses not included in the 2016 AFHSB eye injury case definition were identified as meeting the definition of "injury" established by the taxonomy. This has led to a more in-depth evaluation and validation of the current (2016) AFHSB/TSVCRP case definition. A revision to the AFHSB case definition may result in some future modification**s** to the list eye injury codes that are included in the Taxonomy. **For its initial publication, this taxonomy includes all of the 2016 AFHSB eye injury codes *except the following*:** H31.30 Unspecified choroidal hemorrhage H33.00 Unspecified retinal detachment with retinal break H33.01 Retinal detachment with single break H33.01 Retinal detachment with multiple breaks H33.05 Total retinal detachment **In addition, the following codes** are considered to most often reflect tissue damage resulting from a transfer of external energy so have been ***added*** **to the Taxonomy of injuries:** **H27.1*** to include: Unspecified dislocation of lens Subluxation of lens, right eye Subluxation of lens, left eye Subluxation of lens, bilateral Subluxation of lens, unspecified eye Anterior dislocation of lens, right eye Anterior dislocation of lens, left eye Anterior dislocation of lens, bilateral Anterior dislocation of lens, unspecified eye Posterior dislocation of lens, right eye Posterior dislocation of lens, left eye Posterior dislocation of lens, bilateral Posterior dislocation of lens, unspecified eye **H16.13* Photokeratitis** **H31.02* Solar retinopathy** (e.g., snow blindness, identified in TRADOC Regulation 350-29, Prevention of Heat and Cold Casualties, 2016 and TB MED 508 as a cold weather related injury to monitor) ***NOTE:*** S0230X* Fracture of orbital floor - is captured in the taxonomy as an acute traumatic MSK Injury.

Table D–2. Rhabdomyolysis

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
(Provides ICD-9 codes only) 728.88 (rhabdomyolysis) 791.3 (myoglobinuria) Includes effects associated with condition: Dehydration; effects of heat or exertion: 276.5 (volume depletion; dehydration; hypovolemia) 992.0-992.9 (effects of heat and light) 994.3 (effects of thirst; deprivation of water) 994.4 (exhaustion due to exposure) 994.5 (exhaustion due to excessive exertion)	For purposes of the Injury Taxonomy, **rhabdomyolysis is captured by rhabdomyolysis (M62.82) as a cumulative MSK injury** since the code describes a non-traumatic initiating event. Though the injury occurs from interactions of various body systems, the end result is necrosis of muscle. This condition is often the result of exertion and/or external heat conditions. Because the specific cause will not be clear from the diagnosis code, this injury is not grouped under Environmental–Thermal (Heat/Radiant (Light)) energy transfer. However, this code (M62.82) should be used for identifying heat injuries that are reportable medical events (RMEs). Related conditions or symptoms noted by the AFHSB (2015) case definition (e.g., dehydration or myoglobinuria) are NOT captured in the Injury Taxonomy as "injuries" because they may be due to other causes. A case definition for the specific evaluation of rhabdomyolysis, however, may need to include these related conditions. An additional code, **traumatic ischemia of muscle (T79.6 9), grouped under acute traumatic MSK**, may also be used for describing a form of rhabdomyolysis that results from sudden acute MSK trauma, such as a car accident. The T79.6 9 diagnosis should *not* be captured for heat injury reporting.

Table D–3. Heat Injury

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
(Provides ICD-9 codes only) 992.0 (heat stroke and sunstroke) 992.3 (heat exhaustion, anhydrotic) 992.4 (heat exhaustion due to salt depletion) 992.5 (heat exhaustion, unspecified) 992.9 (unspecified effects of heat)	The ICD-9-CM codes for heat injuries listed in the existing (2015) AFHSB document are translated as ICD-10-CM codes and included in the Taxonomy along with additional codes. RME heat injuries only include heat stroke, heat exhaustion and severe heat injuries (e.g., see above *Rhabdomyolysis (M62.82)).* Though sunburn, heat fatigue, syncope, edema, and cramps are not included as RMEs, they are injuries that result from the transfer of thermal (heat)/radiant (sunlight) energies so are included in the Taxonomy. T67.0XX Heat stroke and sunstroke T67.1XX Heat syncope T67.2XX Heat cramp T67.3XX Heat exhaustion, anhydrotic T67.4XX Heat exhaustion due to salt depletion T67.5XX Heat exhaustion, unspecified T67.6XX Heat fatigue, transient T67.7XX Heat edema, initial encounter T67.9XX Effect of heat and light, unspecified L740 Miliaria rubra L743 Miliaria L55.* Sunburn (of various degrees) E87.1 Hypo-osmolality/hyponatremia ***NOTE:*** Sunlight-related injuries also include eye injuries H16.1 Photokeratitis and H31.02, Solar retinopathy

Table D–4. Cold Injury

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
T33, T34 Frostbite T68 Hypothermia T69 Other effects/immersion	All AFHSB cold-related injury codes are included in this Taxonomy. In addition, though AFSHB (2016) describes T69.* other effects such as "immersion" – it does not specifically note extension codes for chilblains/other conditions, as included in the Taxonomy: T69.1XX Chilblains T69.8XX Other specified effects of reduced temperature T69.9XX Effect of reduced temperature

Table D–5. Cruciate Ligament Injuries

AFHSB Case Definition (2016)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
M23.61, .62 S83.51, S83-52 S83.2	All of the AFHSB (2016) codes for "cruciate ligament injuries" are included in the Taxonomy, grouped as acute traumatic MSK injuries.

Table D–6. Carpal Tunnel Syndrome

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
G56.0 (G56.00, .01, .02)	The AFHSB (2016) codes for "carpal tunnel syndrome" are included in the Taxonomy, grouped as cumulative (microtraumatic) MSK injuries.

Table D–7. Heterotopic Ossification

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
M61.0 (myositis ossificans traumatica) M61.4 (other calcification of muscle) M61.5 (other ossification of muscle) M61.9 (calcification and ossification of muscle, unspecified)	The AFHSB (2015) codes for "heterotopic ossification" are NOT included as defining an injury in this Taxonomy. However, they are captured as long-term MSK effects related to injury. Heterotopic ossification (HO) is the formation of bone tissue outside the skeleton in, or adjacent to, soft tissues that have been injured and is commonly detected 2 months after injury, characterized by increasing pain and decreasing range of motion about a joint. According to the AFHSB (2015), HO has become a frequent and concerning clinical and rehabilitation problem among Service members with severe traumatic injuries from Iraq and Afghanistan.

Table D–8. Spontaneous Rupture of Tendons (Non-traumatic)

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
M66.2, M66.3, M66.8, M66.9	All AFHSB codes for "spontaneous rupture – tendons (non-traumatic)" are included in the Taxonomy, grouped as acute traumatic MSK injuries. Though the AFHSB notes the ICD description as including the term 'non-traumatic,' the potential causes (e.g., sharp starts/stops, jumping) and the description of the injury as "spontaneous", precluded inclusion in the cumulative trauma category. This said, SMEs acknowledge that repetitive stress can increase risk of this injury.

Table D-9. Hearing Loss, Noise-induced "NIHL" & Occupational NIHL

AFHSB Case Definition (2016, 2017)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
H90.3, .4, .5 Sensorineural hearing loss H83.3 Noise-induced hearing loss H93.1 Tinnitus S09.31 (primary blast injury of ear)	All AFHSB (2016) noise-induced hearing injuries ("NIHI"), including occupational-related, are included in the Taxonomy. In addition, though not 'noise induced,' "ototoxic hearing loss" (H91.0*) has been included in this Taxonomy as a poison (drug)-induced injury (as the primary cause is a medicinal substance). It is also noted that though traumatic damage to the ear is captured under the S-code S09.31, various other H-codes may reflect some form of tissue damage from an external energy transfer that results in hearing loss. At this time, however, no additional codes are included.

Table D–10. Traumatic Brain Injury

AFHSB Case Definition (2016)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
Specified S-codes plus F07.81 (post-concussion syndrome)	All AFHSB TBI injuries (S-codes) are included in the Taxonomy; F07.81 is identified as a long-term (Non-MSK) effect along with post-trauma related headache (G-codes)

Table D–11. Osteoarthritis

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
The current AFHSB case definition refers to diagnoses with ICD-9-CM 715 (715.0 - .9). The case definition has not been updated to address ICD-10-CM codes. The AFHSB document refers to these as "work-related injuries" resulting in one hospitalization or two outpatient medical encounters occurring with two years - and provides the following clinical description: "Osteoarthritis (OA), the most common form of arthritis, is a non-inflammatory degenerative joint disease characterized by destruction of cartilage and remodeling of bone at the joints. OA is highly prevalent in the United States and is associated with advancing age. Osteoarthritis can cause a range of symptoms from joint pain and stiffness to more disabling impairment. Risk factors for OA may be inherent to an individual, i.e., obesity, family history, hypermobility and abnormalities of the joint, or related to exposure, i.e., trauma, or overuse from physical activity or occupation."	"Cases of "osteoarthritis" are NOT included as incident injuries in the Taxonomy and therefore should not be included when determining *injury incident rates.* However, some cases of osteoarthritis are considered long-term MSK effects that are likely related to a prior injury (either acute traumatic or cumulative microtraumatic injury). Specifically, codes M16.4, M16.5, M17.2, M17.3, M18.2, and M183 are likely to have resulted from prior injury and thus are MSK long-term effects that represent part of the overall burden of injuries to the military.

Table D–12. Spondylosis

AFHSB Case Definition (2015)	Inclusion/Exclusion/Addition in APHC Injury Taxonomy
The current AFHSB case definition refers to diagnoses with ICD-9-CM 721 (721.0 - .9). The case definition has not been updated to address ICD-10-CM codes. The AFHSB document refers to these as "work-related injuries" resulting in one hospitalization or two outpatient medical encounters occurring with two years - and provides the following clinical description: "Spondylosis, sometimes referred to as degenerative osteoarthritis, or osteoarthritic spine disease, typically occurs in later life and primarily involves the cervical and lumbosacral spine. Patients often complain of back pain that is increased by motion and associated with stiffness or limitation of motion. Pain may be prominent when x-ray findings are minimal; alternatively, large osteophytes may be seen in asymptomatic patients. If severe, the condition may cause pressure on nerve roots and spinal stenosis." Based on this description many additional ICD-10-CM could be included.	Cases of "spondylosis" are NOT included as incident injuries in the Taxonomy and therefore should not be included when determining *incident injury rates*. However, some cases (M43.0, M47.2, M47.8, M47.9) are considered long-term MSK effects that are related to a prior injury ((either acute traumatic or cumulative microtraumatic injury). These long-term conditions are MSK long-term effects that represent part of the overall burden of injuries to the military. These codes do not include other conditions that might fit the AFHSB's description of spondylosis as "degenerative osteoarthritis" or osteoarthritic spine disease." The additional codes for such conditions are included in Table 6 of this document.

APPENDIX E

Injury Code Summary Table:
Summary of ICD-10-CM Codes in Each Injury Category

Table E-1summarizes all of the ICD-10-CM codes (CDC, 2017) identified as injuries in the context of the various injury categories.

TABLE E-1. Summary of Injury Diagnosis Codes (ICD-10-CM)

CODE SERIES	MECHANICAL ENERGY				NON-MECHANICAL ENERGY			OTHER
	ACUTE TRAUMA		CUMULATIVE					
	MSK	Non-MSK	MSK	Non-MSK	Environ-mental	Poisons	Non-Environ-mental	Medical Accidents, unspeci-fied, etc.
E-Code Series								
Hyponatremia					E87.1			
G-Code Series (Nervous system)								
G- Select nerve compression & neuropathies		G44.311,.319 G56.1-.3 G57.01, .3.4,.6 G58.911		G54.0 G56-G57				
H-Code Series (Eye/adnexa, ear/mastoid)								
H- Select eye, ear/hearing injuries		*(Eye injuries)* H05.23; H18.2,.8; H21.0,.5; H26.1, H27.1; H31.3, H33.03, H43.1, H44.00		*(Hearing)* H83.3 H90.3-5 H93.1				
J-Codes (Respiratory system)								
J60-J70 Lung diseases due to external agents						J60-J63, J66-67, J68	J70 *(radiation)*	
K-Codes								
Broken teeth		K08.1*, .4*						
L-Codes (Skin and subcutaneous tissue)								
L- sunburn					L55 Sunburn			
					L74.0. .3 prickly heat milaria rubra			
M-Codes (MSK system/connective tissue)								
M05-M14 Inflammatory polyarthropathies	M12.5**							
M20-M25 Other joint disorders *M20 Acquired deformities of fingers and toes* *M22 Disorder of patella* *M23 Internal derangement of knee* *M24 Other specific joint derangements* *M25 Other joint disorder, NEC*	M20.011,.012 M20.019,.023 M23.3, .6 M24.8, .9 M25.0 M25.4		M22.2*, .4*, .8x,.9x M24.2 M25.5, 8					
M45-M49 Spondylopathies *M48 Other spondylopathies*	M48.3		M48.4					

TABLE E-1. Summary of Injury Diagnosis Codes (ICD-10-CM)

CODE SERIES	MECHANICAL ENERGY				NON-MECHANICAL ENERGY			OTHER
	ACUTE TRAUMA		CUMULATIVE					
	MSK	Non-MSK	MSK	Non-MSK	Environ-mental	Poisons	Non-Environ-mental	Medical Accidents, unspeci-fied, etc.
M50-M54 Other dorsopathies *M50 Cervical disc disorders* *M51 Thoracic, etc disc disorders* *M53 Other and unspecified dorsopathies, NEC* *M54 Dorsalgia (back pain)*			M50.* M51.1,.2,.8 M53.1,.8 M54.4,.5,.6, .8	M54.1* – 3*				
M60-M63 Disorders of muscles M60 Myositis M61 Calcification and ossification of muscle M62 Other disorders of muscle			M60.8 M62.1 M62.8					
M65-M67 Disorders of synovium and tendon *M65 Synovitis & tenosynovitis* *M66 Spontaneous rupture of synovium / tendon* *M67 Other disorders of synovium and tendon*	M66.1,.2.3.8		M65.3 M65.4 M65.8 M67.5					
M70-M79 Other soft tissue disorders *M70-M79 Other soft tissue disorders* *M70 Soft tissue disorders from use, overuse, pressure* *M71 Other bursopathies* *M72 Fibroblastic disorders* *M75 Shoulder lesions* *M76 Enthesopathies, lower limb, excluding foot* *M77 Other enthesopathies* *M79 Other & unspecified soft tissue disorders, NEC*			M70.03, .1, .7, .8 -.9 M71.5, .8 M72.2 M75.1-.5 M76.* M77.* M79.1,6,.A,9					
M95 Other disorder, MSK system &connective tissue		M95.1*						
M96 Intraoperative and postprocedural complications and disorders of MSK system, NEC								M96
R-Codes (Symptoms/signs/abnormal findings, NEC)								
R- Abnormal auditory study				R94.120				
S-Codes								
S00-S09 Injuries to the head	S02(exclude. 5);	S00-01,S02.5, S03.1-2, S04-		S00.*2*				

TABLE E-1. Summary of Injury Diagnosis Codes (ICD-10-CM)

CODE SERIES	MECHANICAL ENERGY				NON-MECHANICAL ENERGY			OTHER
	ACUTE TRAUMA		CUMULATIVE					
	MSK	Non-MSK	MSK	Non-MSK	Environ-mental	Poisons	Non-Environ-mental	Medical Accidents, unspeci-fied, etc.
	S03.0,.4,.8,.9 S07, S09.1	S06,S08, S09.0,.2-.9						
S10-S19 Injuries to the neck	S12, S13, S16-S18	S10-S11, S14, S15, S19.8-.9		S10. .*2*				
S20-S29 Injuries to the thorax	S22, S23, S28.0-.1, S29.0	S20-S21, S24–S27, S28.2, S29.8		S20.*2*				
S30-S39 Injuries to abdomen, lower back, lumbar spine, pelvis, external genitals	S32, S33, S36-S35, S39.0	S30-S31, S34-S38, S39.8-.9		S30.*2*				
S40-S49 Injuries to the shoulder and upper arm	S42, S43, S46-S48, S49.0-.1	S40-S41, S44, S45, S49.8-.9		S40.*2*				
S50-S59 Injuries to the elbow and forearm	S52, S53, S56-S58, S59.0-.2	S50-S51, S54, S55, S59.8-.9		S50.*2*				
S60-S69 Injuries to the wrist, hand and fingers	S62, S63, S66-S68	S60-S61, S64, S65, S69.8-.9		S60.*2*				
S70-S79 Injuries to the hip and thigh	S72, S73, S76-S78, S79.0-.1	S70-S71, S74, S75, S79.8-.9		S70.*2*				
S80-S89 Injuries to the knee and lower leg	S82, S83, S86-S88 S89.0-.3	S80-S81,S84, S785, S89.8-.9		S80.*2*				
S90-S99 Injuries to the ankle and foot	S92, S93, S96-S98	S90-S91, S94, S95, S99.8-.9		S90.*2*				
T-Codes (Injury, poisoning/other consequences of external causes)								
T07, T14 Injury to unspecified or multiple body regions								T07, T14
T15-T19 Foreign body in (eye, ear, respiratory tract, alimentary tract, genitourinary tract)		T15-T19						
T20-T32 Burns and corrosions							T20-T32	
T33-T34 Frostbite					T33-T34			

TABLE E-1. Summary of Injury Diagnosis Codes (ICD-10-CM)

CODE SERIES	MECHANICAL ENERGY				NON-MECHANICAL ENERGY			OTHER
	ACUTE TRAUMA		CUMULATIVE					
	MSK	Non-MSK	MSK	Non-MSK	Environ-mental	Poisons	Non-Environ-mental	Medical Accidents, unspeci-fied, etc.
T36-T50 *(select codes only)* Poisoning by, medicaments and biological substances *EXCLUDE: adverse effect of and under-dosing of drugs*						T36-T50		
T51-T65 Toxic effects of substances chiefly nonmedicinal as to source (e.g., alcohol, chemicals (gases, fumes, corrosives, poisons), noxious foods/plants, toxins, venomous animals and plants)						T51-T65		
T66-T78 Other and unspecified effects of external causes				T75.20-29	T67 - T70 T75 *except .4*		T66 T75.4	T71-T74 T76 T78
T79 Certain early complications of trauma, NEC	T79.6XX	T79.A						T79 *except T79.6*
T80-T88 Surgical complications								T80-T88

APPENDIX F

Example Questions for Injury Surveys

Suggested injury survey questions begin on the next page.

Suggestions for Defining Terms in Injury-related Survey Instruments

The following suggested terminology may be used to inform responders to surveys. Such surveys may begin with an explanation such as that provided below.

For purposes of this survey:

Scope: Questions are about NON-COMBAT injuries you have experienced.

Definition of injury: An "injury" refers to damage to your body that was caused by either (1) a sudden one-time event *or* (2) a repeated stress or exposure over several hours, days, or weeks. An injury causes pain, impairs physical capabilities, and results in complete or partial days of limited activity. An injury may resolve on its own in a day or take several weeks and require medical treatment.

> NOTE: Conditions that are unresolved and still cause pain and require medical treatment for longer than three months are no longer "injuries" – the condition has evolved into a long-term effect or chronic condition.

Injury severity: The severity of an injury is based on the number of days it limited your activity as well as the medical treatment required. Injury severity is scaled as:

Days of limited activity	0-1	2-7	>7-14	>14-30	>30
Medical visits	0	1	2	3-8	>8

Injury types**:** Review the descriptions and examples for different types of injury and indicate the number, if any, of injuries you experienced in the past 12 months.

INJURY TYPE	**Examples**	**# of unique injuries in past 12 months**
Sudden contact with an object, surface, animal, or human	Motor vehicle accidents, falling off truck, bumping into equipment, cut with sharp abject, firearms accident, blow to head animal bite	
Sudden pain from a single awkward or overly forceful physical movement	Twisted ankle while running, strain in back when lifting/pulling, pain in leg while running	
Gradual pain or damage to body from continued or repeated physical activity	Knee pain caused by running and/or marching, back pain from repeated lifting/carrying heavy loads, blisters from marching	
Damage to body caused by a natural environmental hazard	Heat stroke, sunburn, altitude illness, frostbite, lightning	
Damage to body caused by fires, electricity, radiation	Burns, electrocution	
Poisoning	From medicine, recreational drug, toxic chemical (including corrosive burns), insect/snake/plant	
Drowning accident	Swimming, bathing	
Accident/unexpected damage to body from medical procedures	Accidental foreign object left in body during surgery	
Other unintended physical damage to	Describe:	

body		

Injury descriptions: Provide the requested information about [your injury] or [your two most severe injuries]:

INJURY TYPE	**Injury 1 – *Select items that you consider to be BEST descriptor***	
Sudden contact with an object, surface, animal, or human	**Body part injured:** *(choose best fit):* o Head o Neck o Eye o Ear o Upper back o Lower back o Chest o Shoulder o Abdomen o Upper arm o Elbow o Lower arm o Hand/fingers o Hip o Upper leg o Knee o Lower leg o Ankle o Foot/toes **Description of body damage:** o Internal Bleeding o Broken bone o Strain/sprain o Blister o Multiple body systems not functioning o Loss of consciousness o Swelling/bruise o Pain/otherwise not sure o Other - Describe: **Days of limited activity** 0-1 2-7 >7-14 >14-30 >30 **Medical visits** 0 1 2 3-8 >8	**Activity Scenario** *(choose best fit):* o Motor vehicle accident – Non-military o Motor vehicle accident – Military o Motorcycle o ATV o Boat/water-related o Airplane/helicopter o Sport – Basketball o Sport – Football o Sport – Skiing/Snowboarding o Sport – Soccer o Sport – Other o Physical fitness training – Running o Physical fitness training – Weights o Physical fitness training – Agility o Physical fitness training – Stretching o Physical fitness training – Other o Parachuting o Military training – Combat training o Military training – Obstacle course o Military training – Foot Marching o Military Work Duty– Infantry o Military Work Duty– Armor o Military Work Duty– Artillery o Military Work Duty– Healthcare o Military Work Duty–Other combat o Military Work Duty–Other Non-combat o Horseplay o Firearms/weapons non-combat o Home/Off duty non-sport/fitness o Other

Glossary

AFHSB	Armed Forces Health Surveillance Branch
AIT	Advanced Individual Training
APHC	Army Public Health Center
BCT	Basic Combat Training
CDC	Centers for Disease Control and Prevention
CY	calendar year
DA	Department of the Army
DART	days away, restricted, or transferred from work activity
DHA	Defense Health Agency
DHHS	Department of Health and Human Services
DMSS	Defense Medical Surveillance System
DOD/DoD	Department of Defense
DoDI	Department of Defense Instruction
ICD	International Classification of Diseases
IET	Initial Entry Training
IIR	Installation Injury Report
IOM	Institute of Medicine
IPD	Injury Prevention Division
MSD	musculoskeletal disorders
MSK	musculoskeletal
MSMR	*Medical Surveillance Monthly Reports*
NEC	not elsewhere classified
NIOSH	National Institute for Occupational Safety and Health
NRC	National Research Council
OSHA	Occupational Safety and Health Administration
OSUT	One Station Unit Training
PH360	Public Health 360
SME	subject matter expert
SMS	Strategic Management System
STS	Standard Threshold Shift

TRIR	Training-Related Injury Report
USACRC	U.S. Army Combat Readiness Center
WHO	World Health Organization
WISQARS	Web-based Injury Statistics Query and Reporting System

U.S. Army Public Health Center

Public Health Information Paper

Addendum 1
A Taxonomy of Injuries for Public Health Monitoring and Reporting

PHIP No. 12-01-0717

General Medical: 500A

November 2017

USAPHC

ADDENDUM 1
PUBLIC HEALTH INFORMATION PAPER NO. 12-01-0717
A TAXONOMY OF INJURIES FOR PUBLIC HEALTH MONITORING AND REPORTING:

BODY REGIONS AND INJURY TYPES

1 REFERENCES

Appendix A provides the references cited in this Addendum.

2 PURPOSE

This addendum expands on the results of the Army Public Health Center (APHC) taxonomy of injuries (reference 1). Specifically, for each International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) injury code identified by the taxonomy, this addendum describes the process used to additionally assign unique body regions and nature of injury types.

3 BACKGROUND

The APHC injury taxonomy (reference 1) organizes injuries based on the causal form and source of an energy transfer to the body. The 'transfer of energy to the body' has been described as the conceptual basis for defining injuries for decades but has not previously been operationalized. The taxonomy structure uniquely associates each applicable ICD-10-CM injury diagnosis code to a single energy type (e.g., mechanical—acute trauma and cumulative micro-trauma, environmental (heat/light, cold, and so forth), poisoning, and so forth). Because external cause codes (e.g., "E-codes") are not adequately captured in military medical records (compliance only 10% for outpatient visits in 2016) (reference 2), the APHC proposes to use the taxonomic energy transfer categories and subcategories as an indicator of types of activities that lead to injury. Prevention strategies can further be targeted with an understanding of the most frequently injured body regions and types of injury (e.g., fractures versus burns, acute traumatic versus micro-traumatic).

4 METHOD

A standardized list of body regions and nature of injury types was adapted from existing matrices and assigned individual taxonomy ICD-10-CM codes (references 3–10). The existing injury reporting matrices traditionally used in national public health reports (references 3–8) have addressed only acute traumatic injuries. This addendum applies the same standardized body region and nature of injury matrix to all of the injuries described by the taxonomic structure, including repetitive lower intensity (cumulative micro-traumatic) injuries.

5 RESULTS

Table 1 and Figure 1 present the standardized list of body regions. Table 2 describes the types on injuries. Table 3 is an example template matrix for summarizing results for this type of data request.

6 CONCLUSIONS AND RECOMMENDATIONS

An injury taxonomy Excel® spreadsheet, available on request, now aligns each taxonomy ICD-10-CM injury code with an energy group and now also a body region and injury type as described by this addendum. Because the vast majority of injuries are caused by mechanical energy transfer to the musculoskeletal (MSK) system (references 1 and 11, MSK injuries are suggested to be presented first in a data output matrix (example as Table 3); this is a change from the formats used in traditional public health reporting of acute traumatic injuries.

Table 1. Body Regions Assigned to All Injury ICD-10-CM Codes[a]

Body Region.1[b]	Body Region.2[b]	Additional details
HEAD & NECK	Traumatic brain injury (TBI)[c]	Based on previously identified conditions/ codes [b, c]
	Other head	Includes scalp, skull
	Face	Includes cheeks, mouth, lips, and teeth
	Eye	Eye and eye orbit
	Ear	Includes hearing-loss injury
	Neck	Includes inner throat, trachea
	Head/Neck, Other	Unspecified, multiple site, other
SPINE & BACK	Upper Back	Cervical region
	Middle Back	Thoracic, Dorsal region
	Lower Back	Lumbar, Sacral, Coccyx
	Spine/Back, other	Unspecified, multiple sites, other
TORSO	Chest	Thorax, sternum, clavicle, brachial plexus, lung, heart, ribs
	Abdomen	Stomach, alimentary system
	Pelvis	Pelvic girdle, spleen, liver, kidney, pancreas, genitalia (urogenital)
	Trunk, other	Buttocks, unspecified, multiple site, other
UPPER EXTREMITIES	Shoulder	Joint region (→ includes scapula)
	Upper Arm	Below/from shoulder → humerus (→ elbow)
	Elbow	Joint (→forearm); includes ligaments, cartilage, synovium, bursa
	Lower Arm	Below/from elbow → may include wrist/hand
	Forearm	No joint, radius, ulna (no wrist/elbow)
	Wrist	Joint (→hand); includes ligaments, cartilage, synovium, bursa
	Hand, Finger	hand and/or finger(s)/thumb
	Arm, other	Unspecified, multiple sites, other
LOWER EXTREMITIES	Hip	Pelvic joint region (→upper femur)
	Upper leg	Below/from hip → thigh (→ knee)
	Knee	Joint region & patella (→lower leg)
	Lower leg	Knee →ankle→foot
	Ankle	Joint region (→foot)
	Foot, Toes	Foot and/or toe(s)
	Leg, Other	Unspecified, multiple sites, other
OTHER	System-wide	Systemic effects
	Multiple	Multiple body regions, systems, or tissues
	Unspecified	Body tissue/region damage is not specified

Notes:

[a] Per APHC PHIP 12-01-0717, "A Taxonomy of Injuries for Public Health Monitoring and Reporting" (reference 1).

[b] Adapted from Barell (reference 3); CDC (reference 4); CDC (reference 5); Hedegaard (reference 6); Bergen (reference 7); Annest (reference 8); Hauret (reference 9).

[c] Adapted from Traumatic Brain Injury (TBI) Case definition, Armed Forces Health Surveillance Branch, April 2016 (reference 10).

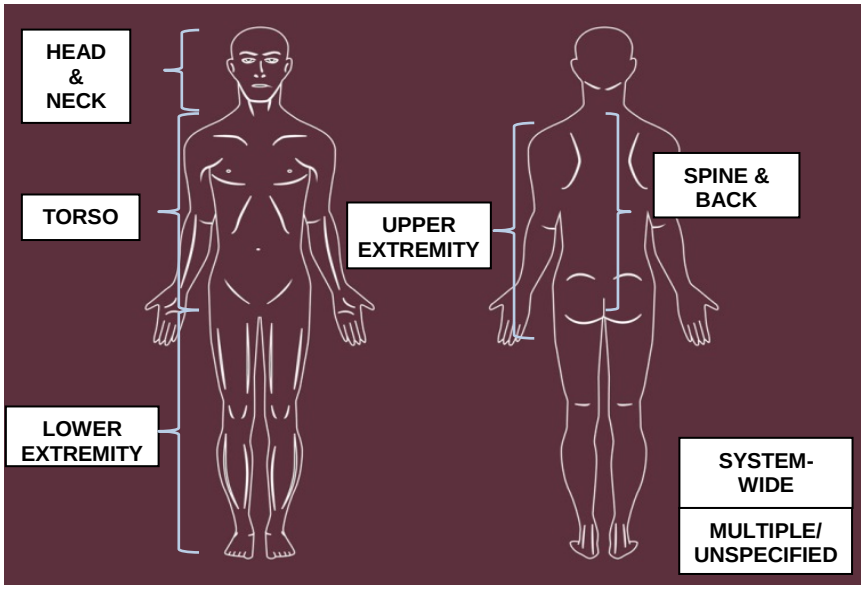


Figure 1. Body Regions Applied to Injury Codes[a,b]

Table 2. Nature of Injury Types Applied to All Injury ICD-10-CM Codes[a]

Primary system	Injury Type [b]	Description
Musculoskeletal (MSK)	**Fracture**	Traumatic (open, closed) or Cumulative Micro-traumatic (stress fracture) [c]
	Dislocation	Traumatic displacement of bone or joint [c]
	Sprain/Joint Damage	Traumatic damage to joint tissue: i.e., derangements, or other joint/cartilage/ ligament/synovial/bursa rupture or tear [c]
	Strain/Tear	Traumatic or cumulative micro-traumatic damage (i.e., stretch, tear, or rupture) to muscle or tendon tissue [c]
	MSK Tissue Damage, Other	Other traumatic or cumulative micro-traumatic MSK tissue damage that results in inflammation (e.g., fluid accumulation), pain, tissue dysfunction, and/or limits physical ability
	Amputation	Traumatic removal of specified body part
Non-Musculoskeletal	**Nerve**	Traumatic or Cumulative Micro-traumatic damage to specific nerve
	Crush	Traumatic damage to body tissue resulting from crushing
	Internal Organ & Blood Vessel	Traumatic damage to brain & spinal cord, lung, liver, stomach, spleen, kidney, pancreas, gallbladder, intestines, urogenital; veins/arteries
	Open Wound	Traumatic damage to skin, with/without other body tissue
	Burns & Corrosion	Traumatic damage from burns (heat/thermal energy) or corrosion (chemical energy) [a]
	Contusion/Superficial	Traumatic (bruises, lacerations, abrasions) or Cumulative Micro-traumatic (friction blister) damage to outer skin layers
	Tissue Damage, Other	Traumatic damage to non-MSK tissues not otherwise described that causes inflammation (e.g., fluid accumulation), pain, tissue dysfunction, and/or limits physical ability
Other	**System-wide Multiple sites/systems Unspecified**	Injury/tissue damage that is system-wide, multiple systems/tissues, or not specified. Includes damage by specific external energies (i.e., heat/sun; cold; altitude/pressure; foreign body in orifice/body tissue; lightning; electricity; radiation; asphyxiation/drowning; medical accident; medical complications; poisons/chemicals/toxins; other trauma] [a,d]

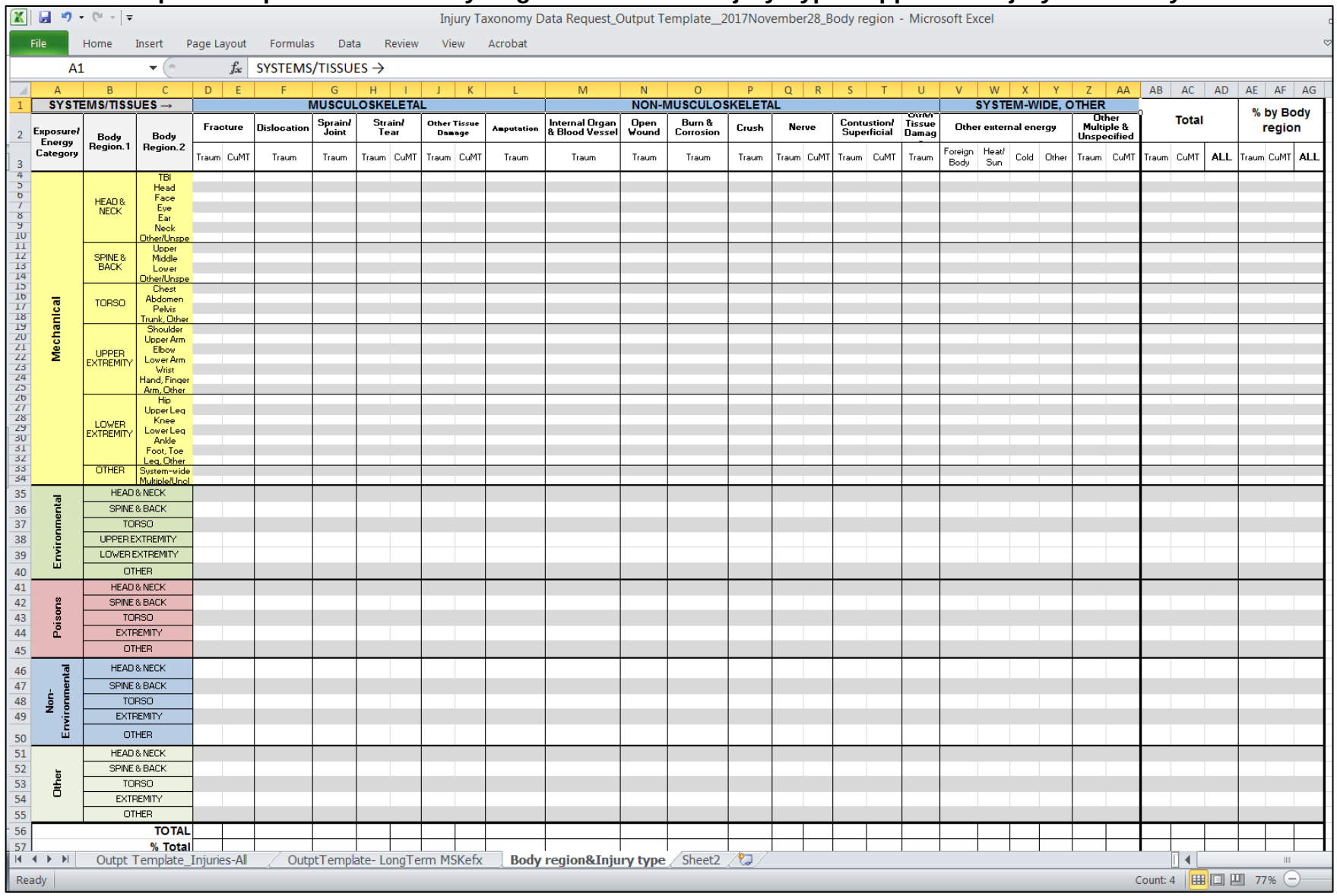
[a] Per APHC PHIP 12-01-0717, "A Taxonomy of Injuries for Public Health Monitoring and Reporting" (reference 1).

[b] Adapted from Barell (reference 3); CDC (reference 4); CDC (reference 5); Hedegaard (reference 6); Bergen (reference 7); Annest (reference 8); Hauret (reference 9).

[c] Further defined in APHC Injury Prevention Factsheet 12-011-0417 "Musculoskeletal Injuries" (reference 11) available at: https://phc.amedd.army.mil/PHC%20Resource%20Library/MSKInjuries_FS_12-011-0417.pdf

[d] For purposes of most reporting the "Other" external causes identified in Excel groups will be collapsed into a single subcategory.

Table 3. Template Output Table for Body Region & Nature of Injury Types Applied to Injury Taxonomy[1*]



*this is an example output matrix; studies may organize results differently

Appendix A
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U.S. Army Public Health Center

Public Health Information Paper

Addendum 2
A Taxonomy of Injuries for Public Health Monitoring and Reporting

PHIP No. 12-01-0717

General Medical: 500A

December 2017

USAPHC

ADDENDUM 2
PUBLIC HEALTH INFORMATION PAPER NO. 12-01-0717
A TAXONOMY OF INJURIES FOR PUBLIC HEALTH MONITORING AND REPORTING:

FISCAL YEAR 2018 UPDATE

1 REFERENCES

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2 PURPOSE

This addendum expands on the results of the Army Public Health Center (APHC) taxonomy of injuries (reference 1). Specifically, this addendum describes the updated Fiscal Year (FY) 2018 International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes that would apply to the injury taxonomy for medical data obtained after October 2017.

3 BACKGROUND

The APHC injury taxonomy (reference 1) defines injury categories based on the type of causal external energy and assigns applicable ICD-10-CM diagnosis codes to each category. The total of all codes and categories defines "all injuries." The taxonomy identified codes using the official ICD-10-CM 2016-2017 list. The ICD code list is reevaluated and updated annually by the CDC. For clinical applications 1 October 2017 to 30 September 2018, the CDC released the FY 2018 update in September 2017 (reference 2). This FY 2018 included 360 additions, 142 deletions, and 226 revisions.

4 METHOD

All new, deleted, and revised codes were evaluated and compared with established taxonomic structure and selected (2016–2017) ICD-10-CM codes. Codes that met criteria as injuries were documented in this addendum.

5 RESULTS

Table 1 presents the list of deleted and added codes that are identified as injuries in the taxonomy. Table 2 presents the modified descriptions of the revised codes that are injuries.

6 CONCLUSIONS AND RECOMMENDATIONS

The changes do not significantly impact the APHC injury taxonomy injury codes. However, studies using medical records after 30 September 2017 should use the new codes. A version of the APHC injury taxonomy Excel® spreadsheet, available on request, now includes indicators for new, delated, and modified ICD-10-CM codes. This is in addition to the original taxonomic association of each code with an energy group (reference 1), as well as body region and injury type (reference 3).

Table 1. ICD-10-CM INJURY CODES IN APHC PHIP[1] DELETED OR ADDED IN FY2018

DELETED CODES (16)		ADDED CODES (4)	
S63131A	Subluxation of proximal interphalangeal joint of right thumb, initial encounter		
S63132A	Subluxation of proximal interphalangeal joint of left thumb, initial encounter		
S63133A	Subluxation of proximal interphalangeal joint of unspecified thumb, initial encounter		
S63134A	Dislocation of proximal interphalangeal joint of right thumb, initial encounter		
S63135A	Dislocation of proximal interphalangeal joint of left thumb, initial encounter		
S63136A	Dislocation of proximal interphalangeal joint of unspecified thumb, initial encounter		
S63141A	Subluxation of distal interphalangeal joint of right thumb, initial encounter		
S63142A	Subluxation of distal interphalangeal joint of left thumb, initial encounter		
S63143A	Subluxation of distal interphalangeal joint of unspecified thumb, initial encounter		
S63144A	Dislocation of distal interphalangeal joint of right thumb, initial encounter		
S63145A	Dislocation of distal interphalangeal joint of left thumb, initial encounter		
S63146A	Dislocation of distal interphalangeal joint of unspecified thumb, initial encounter		
T07	Unspecified multiple injuries	T07XXXA	Unspecified multiple injuries, initial encounter
T148	Other injury of unspecified body region	T148XXA	Other injury of unspecified body region, initial encounter
T1490	Injury, unspecified	T1490XA	Injury, unspecified, initial encounter
T1491	Suicide attempt	T1491XA	Suicide attempt, initial encounter

Note:

* Deleted S codes will not be used by providers after 1 October 2017 so no encounter data can be captured; additional new 4 codes (T-codes) are replacing original 5-digit T-code; taxonomy categorization, body region, or injury type of these injuries did not change.

TABLE 1. ICD-10-CM INJURY CODES IN APHC PHIP[1] WITH REVISED DESCRIPTIONS IN FY2018*

CODE	NEW DESCRIPTION (FY2018)	OLD DESCRIPTION
S04031A	Injury of optic tract and pathways, right side, initial encounter	Injury of optic tract and pathways, right eye, initial encounter
S04032A	Injury of optic tract and pathways, left side, initial encounter	Injury of optic tract and pathways, left eye, initial encounter
S04039A	Injury of optic tract and pathways, unspecified side, initial encounter	Injury of optic tract and pathways, unspecified eye, initial encounter
S04041A	Injury of visual cortex, right side, initial encounter	Injury of visual cortex, right eye, initial encounter
S04042A	Injury of visual cortex, left side, initial encounter	Injury of visual cortex, left eye, initial encounter
S04049A	Injury of visual cortex, unspecified side, initial encounter	Injury of visual cortex, unspecified eye, initial encounter
S62311A	Displaced fracture of base of second metacarpal bone, left hand, initial encounter for closed fracture	Displaced fracture of base of second metacarpal bone. left hand, initial encounter for closed fracture
S62311B	Displaced fracture of base of second metacarpal bone, left hand, initial encounter for open fracture	Displaced fracture of base of second metacarpal bone. left hand, initial encounter for open fracture
S62317A	Displaced fracture of base of fifth metacarpal bone, left hand, initial encounter for closed fracture	Displaced fracture of base of fifth metacarpal bone. left hand, initial encounter for closed fracture
S62317B	Displaced fracture of base of fifth metacarpal bone, left hand, initial encounter for open fracture	Displaced fracture of base of fifth metacarpal bone. left hand, initial encounter for open fracture
S62341A	Nondisplaced fracture of base of second metacarpal bone, left hand, initial encounter for closed fracture	Nondisplaced fracture of base of second metacarpal bone. left hand, initial encounter for closed fracture
S62341B	Nondisplaced fracture of base of second metacarpal bone, left hand, initial encounter for open fracture	Nondisplaced fracture of base of second metacarpal bone. left hand, initial encounter for open fracture
S62347A	Nondisplaced fracture of base of fifth metacarpal bone, left hand, initial encounter for closed fracture	Nondisplaced fracture of base of fifth metacarpal bone. left hand, initial encounter for closed fracture
S62347B	Nondisplaced fracture of base of fifth metacarpal bone, left hand, initial encounter for open fracture	Nondisplaced fracture of base of fifth metacarpal bone. left hand, initial encounter for open fracture
S62620A	Displaced fracture of middle phalanx of right index finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of right index finger, initial encounter for closed fracture
S62620B	Displaced fracture of middle phalanx of right index finger, initial encounter for open fracture	Displaced fracture of medial phalanx of right index finger, initial encounter for open fracture
S62621A	Displaced fracture of middle phalanx of left index finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of left index finger, initial encounter for closed fracture
S62621B	Displaced fracture of middle phalanx of left index finger, initial encounter for open fracture	Displaced fracture of medial phalanx of left index finger, initial encounter for open fracture
S62622A	Displaced fracture of middle phalanx of right middle finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of right middle finger, initial encounter for closed fracture
S62622B	Displaced fracture of middle phalanx of right middle finger, initial encounter for open fracture	Displaced fracture of medial phalanx of right middle finger, initial encounter for open fracture
S62623A	Displaced fracture of middle phalanx of left middle finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of left middle finger, initial encounter for closed fracture
S62623B	Displaced fracture of middle phalanx of left middle finger, initial encounter for open fracture	Displaced fracture of medial phalanx of left middle finger, initial encounter for open fracture
S62624A	Displaced fracture of middle phalanx of right ring finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of right ring finger, initial encounter for closed fracture
S62624B	Displaced fracture of middle phalanx of right ring finger, initial encounter for open fracture	Displaced fracture of medial phalanx of right ring finger, initial encounter for open fracture
S62625A	Displaced fracture of middle phalanx of left ring finger, initial encounter for closed fracture	Displaced fracture of medial phalanx of left ring finger, initial encounter for closed fracture
S62625B	Displaced fracture of middle phalanx of left ring finger, initial encounter for open fracture	Displaced fracture of medial phalanx of left ring finger, initial encounter for open fracture

S62650A	Nondisplaced fracture of middle phalanx of right index finger, initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of right index finger, initial encounter for closed fracture
S62650B	Nondisplaced fracture of middle phalanx of right index finger, initial encounter for open fracture	Nondisplaced fracture of medial phalanx of right index finger, initial encounter for open fracture
S62651A	Nondisplaced fracture of middle phalanx of left index finger, initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of left index finger, initial encounter for closed fracture
S62651B	Nondisplaced fracture of middle phalanx of left index finger, initial encounter for open fracture	Nondisplaced fracture of medial phalanx of left index finger, initial encounter for open fracture
S62652A	Nondisplaced fracture of middle phalanx of right middle finger, initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of right middle finger, initial encounter for closed fracture
S62652B	Nondisplaced fracture of middle phalanx of right middle finger, initial encounter for open fracture	Nondisplaced fracture of medial phalanx of right middle finger, initial encounter for open fracture
S62653A	Nondisplaced fracture of middle phalanx of left middle finger, initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of left middle finger, initial encounter for closed fracture
S62653B	Nondisplaced fracture of middle phalanx of left middle finger, initial encounter for open fracture	Nondisplaced fracture of medial phalanx of left middle finger, initial encounter for open fracture
S63121A	Subluxation of interphalangeal joint of right thumb, initial encounter	Subluxation of unspecified interphalangeal joint of right thumb, initial encounter
S63122A	Subluxation of interphalangeal joint of left thumb, initial encounter	Subluxation of unspecified interphalangeal joint of left thumb, initial encounter
S63123A	Subluxation of interphalangeal joint of unspecified thumb, initial encounter	Subluxation of unspecified interphalangeal joint of unspecified thumb, initial encounter
S63124A	Dislocation of interphalangeal joint of right thumb, initial encounter	Dislocation of unspecified interphalangeal joint of right thumb, initial encounter
S63125A	Dislocation of interphalangeal joint of left thumb, initial encounter	Dislocation of unspecified interphalangeal joint of left thumb, initial encounter
S63126A	Dislocation of interphalangeal joint of unspecified thumb, initial encounter	Dislocation of unspecified interphalangeal joint of unspecified thumb, initial encounter
S92521A	Displaced fracture of middle phalanx of right lesser toe(s), initial encounter for closed fracture	Displaced fracture of medial phalanx of right lesser toe(s), initial encounter for closed fracture
S92521B	Displaced fracture of middle phalanx of right lesser toe(s), initial encounter for open fracture	Displaced fracture of medial phalanx of right lesser toe(s), initial encounter for open fracture
S92522A	Displaced fracture of middle phalanx of left lesser toe(s), initial encounter for closed fracture	Displaced fracture of medial phalanx of left lesser toe(s), initial encounter for closed fracture
S92522B	Displaced fracture of middle phalanx of left lesser toe(s), initial encounter for open fracture	Displaced fracture of medial phalanx of left lesser toe(s), initial encounter for open fracture
S92523A	Displaced fracture of middle phalanx of unspecified lesser toe(s), initial encounter for closed fracture	Displaced fracture of medial phalanx of unspecified lesser toe(s), initial encounter for closed fracture
S92523B	Displaced fracture of middle phalanx of unspecified lesser toe(s), initial encounter for open fracture	Displaced fracture of medial phalanx of unspecified lesser toe(s), initial encounter for open fracture
S92524A	Nondisplaced fracture of middle phalanx of right lesser toe(s), initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of right lesser toe(s), initial encounter for closed fracture
S92524B	Nondisplaced fracture of middle phalanx of right lesser toe(s), initial encounter for open fracture	Nondisplaced fracture of medial phalanx of right lesser toe(s), initial encounter for open fracture
S92525A	Nondisplaced fracture of middle phalanx of left lesser toe(s), initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of left lesser toe(s), initial encounter for closed fracture
S92525B	Nondisplaced fracture of middle phalanx of left lesser toe(s), initial encounter for open fracture	Nondisplaced fracture of medial phalanx of left lesser toe(s), initial encounter for open fracture
S92526A	Nondisplaced fracture of middle phalanx of unspecified lesser toe(s), initial encounter for closed fracture	Nondisplaced fracture of medial phalanx of unspecified lesser toe(s), initial encounter for closed fracture
S92526B	Nondisplaced fracture of middle phalanx of unspecified lesser toe(s), initial encounter for open fracture	Nondisplaced fracture of medial phalanx of unspecified lesser toe(s), initial encounter for open fracture

Note:
* Changes in description were considered minor and did not change the taxonomy categorization, body region, or injury type of these injuries.